Sept.

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Science and Invention

IN PICTURES

FLAME THROWER PROTECTS EXPLORERS

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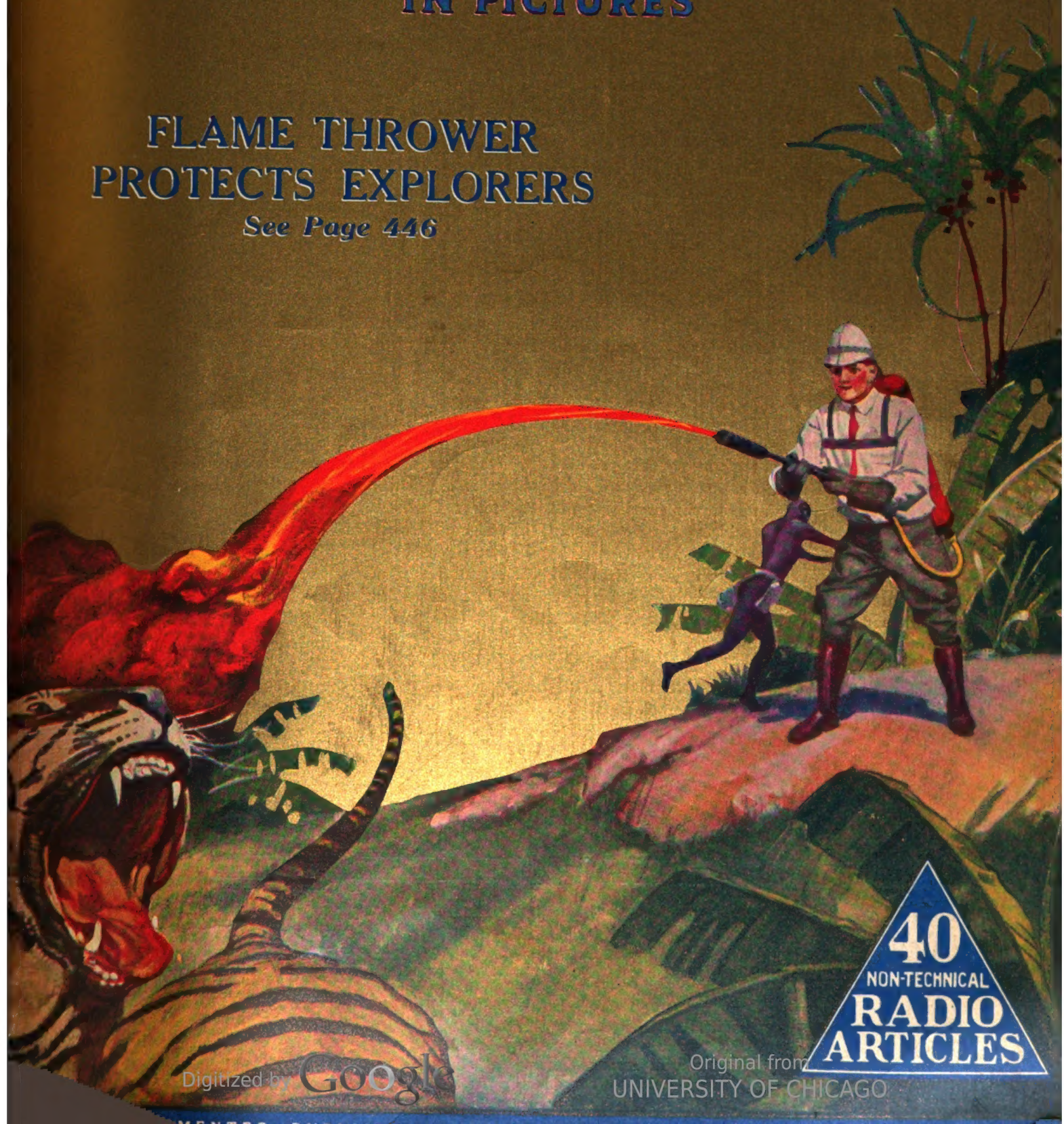

40 NON-TECHNICAL RADIO ARTICLES

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I Can Qualify You as a Radio Expert in a Few Months!

E. R. HAAS
Director, National Radio Institute.

Learn at Home Earn $2500 to $10,000 a Year

Merle Wetzel, one of my students, reports that he is now making *three times* what he did before becoming a radio expert. Emmett Welch writes that after finishing my training, he made $300 a month and all expenses. George Jones says: "To your course I credit my present position as manager of this Radio Department." Another graduate is now an operator of a broadcasting station, PWX of Havana, Cuba, and earns $250 a month. Still another graduate, only 16 years old, is averaging $70 a week in a radio store. Hundreds of other former students enthusiastically tell of their successes as radio experts! The field of Radio today is a real treasure house of wonderful opportunities. It offers rewards beyond your fondest dreams! Mail coupon today for my Free Book just out—which explains in detail the amazing opportunities in this World's Fastest-Growing Industry.

Hundreds of Big Paying Positions Waiting

Do you want to earn far more money than you ever dreamed possible? Do you want to be your own boss?—to have a profitable business of your own? Do you want to travel the whole world over—and make big money while doing so?

Radio offers you all of these opportunities—and more! Radio, the new infant industry; Radio, growing with leaps and bounds; Radio, the field of endeavor with the most promising future of all!

Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer"—"We want men with executive ability in addition to radio knowledge to become our local managers"—"We require the services of several resident demonstrators"—these are just a few small indications of the great variety of opportunities open to our graduates.

Pay Increases Over $100 a month

I am averaging anywhere from $75 to $150 a month more than I was making before enrolling with you. I would not consider $10,000 too much for the course.
(signed) A. N. Long,
120 No. Main St.,
Greensburg, Pa.

Doubles Salary

I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately $3,000 over and above what I would have earned had I not taken it.
T. Winder,
731 Belford Ave.,
Grand Junction, Colo.

From $15 to $80 a Week

Before I enrolled with you I was making $15 a week on a farm. Now, I earn from $2,080 to $4,420 a year, and the work is a hundred times easier than before. Since graduating a little over a year ago, I have earned almost $4,000 and I believe the course will be worth at least $100,000 to me.
(signed)
Geo. A. Adams,
Route 1, Box 10,
Tamaqua, Pa.

This Wonderful FREE BOOK Has Shown Thousands The Way To Bigger Money

This Free Book has opened the eyes of thousands to the glorious opportunities in Radio. Never in all history has an industry jumped into prominence so rapidly! Millions of dollars now spent yearly on Radio. Hundreds of big money positions have been created almost overnight. Thousands of men trained in Radio are needed. If you are ambitious—if you are looking for a field which offers *big money, fascinating work, advancement, and a real future*, send for this Free Book. It costs you nothing. You obligate yourself in no way. Yet this book can easily mean all the difference between the work you are doing now and wonderful success! Before you forget—mail the coupon NOW!

NATIONAL RADIO INSTITUTE
Dept. 14-JA
Washington, D.C.

E. R. HASS,
NATIONAL RADIO INSTITUTE,
Dept. 14-JA, Washington, D. C.

Without obligation on my part, please send me the free book "Rich Rewards in Radio," with full details as to how I can quickly train for the position of "Certified Radiotrician" in my spare hours at home. Also tell me how your free Employment Service will help me secure a good paying position, and about your special short-time offer. Please write plainly.

Name ..... Age.....

Street ..... Occupation.....

City ..... State.....

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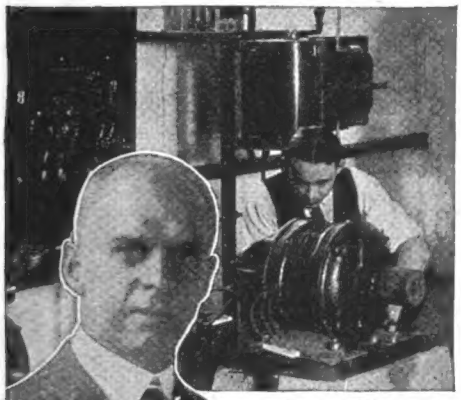
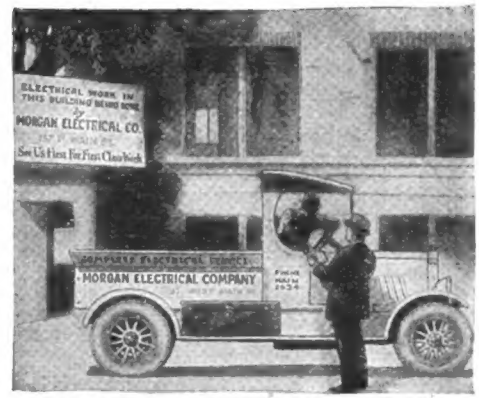


Herbert Dickerson, Warrenton, Va., makes $7,500 a year

Automotive Electricity pays W. E. Pence, Albany, Oregon, over $9,000 a year



J. R. Morgan, Columbus, Ohio, makes $30 to $50 a day in business for himself

Electrical Experts Are in Big Demand

I Will Train You at Home To Fill a Big Pay Job

It's a shame for you to earn $15 or $20 or $30 a week, when in the same six days as an Electrical Expert you can make $70 to $200 a week—and do it easier—not work half so hard. Why then remain in the small-pay game, in a line of work that offers no chance, no big promotion, no big income? Fit yourself for a real job in the great electrical industry. I'll show you how.

Be an Electrical Expert

Earn $3,500 to $10,000 a Year

Today even the ordinary Electrician— the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the "Electrical Expert"—who is picked out to "boss" the ordinary Electricians—to boss the Big Jobs—the jobs that pay $3,500 to $10,000 a Year. Get in line for one of these "Big Jobs" by enrolling now for my easily learned, quickly grasped, right-up-to-the-minute, Spare-Time Home-Study Course in Practical Electricity.

Electricity—the World's Big Pay Field

Electricity is the field of the greatest opportunities. In all other trades and professions competition is so keen from over-crowding that only the exceptional man can get to the top.

Not so in the Electrical line.

Here is a profession that is fairly bubbling with possibilities — with thousands of chances for wonderful success. We stand today on the very threshold of the real Electrical Age—an Age when everything now operated by steam or gas or horses, will be moved by Electricity. But it is an Age demanding specialists—trained men — Electrical Experts. Such men can easily earn from $12 to $30 a day.

Money is being poured into the Electrical Industry at the rate of a billion dollars a year. Think of it—a thousand million dollars a year for electrical expansion. This means—men—jobs—opportunities.

My big book the "Vital Facts" of the electrical industry and the wonderful opportunities that await "Cooke Trained Men" tells you all about this Big Pay Field.

Mail Coupon for the Free Vital FACTS

Age or Lack of Experience No Drawback

You don't have to be a College Man; you don't have to be a High School Graduate. As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training you need, and I will give you that training. My Course in Electricity is the most simple, thorough and successful in existence, and offers every man, regardless of age, education, or previous experience, the chance to become, in a very short time, an "Electrical Expert," able to make from $70 to $200 a week.

FREE Electrical Working Outfit FREE

With me, you do practical work—at home. You start right in after your first few lessons to work at your profession in the regular way. For this you need tools, and I give them to you absolutely free—a whole kit, a complete outfit, one that would cost you $12 to $15.

Your Satisfaction Guaranteed

So sure am I that you can learn Electricity—so sure am I that after studying with me, you, too, can get into the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition, if, when you have finished my Course, you are not satisfied it was the best investment you ever made.

Guarantee Backed by a Million Dollar Institution

Back of me in my guarantee, stands the Chicago Engineering Works, Inc., a million dollar institution, thus assuring to every student enrolled, not only a wonderful training in Electricity, but an unsurpassed Student Service as well.

It's this Service that makes "Cooke" training different from any other training. It's this Service, plus "Cooke" Training, that makes the "Cooke" Trained Man the "Big-Pay Man," everywhere.

Be a "Cooke" Trained Man and earn $12 to $30 a day—$70 to $200 a week—$3,500 to $10,000 a year.

Get Started Now—Mail Coupon

I want to send you my Electrical Book and Proof Lessons both Free. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in Coupon—NOW.

L. L. Cooke, Chief Engineer

Chicago Engineering Works

2150 Lawrence Ave., Dept. 26 Chicago

Use this Free Outfit Coupon!

L. L. COOKE, Dept. 26 The Man Who Makes "Big-Pay" Men
2150 Lawrence Ave., Chicago

Dear Sir: Send at once, Sample Lessons, your Big Book, and full particulars of your Free Outfit and Home Study Course, also the Free Radio Course—all fully prepaid without obligation on my part.

Name .....

Address .....

Occupation .....

The "Cooke" Trained Man is the "Big Pay" Man

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Whole No. 137

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September, 1924
No. 5

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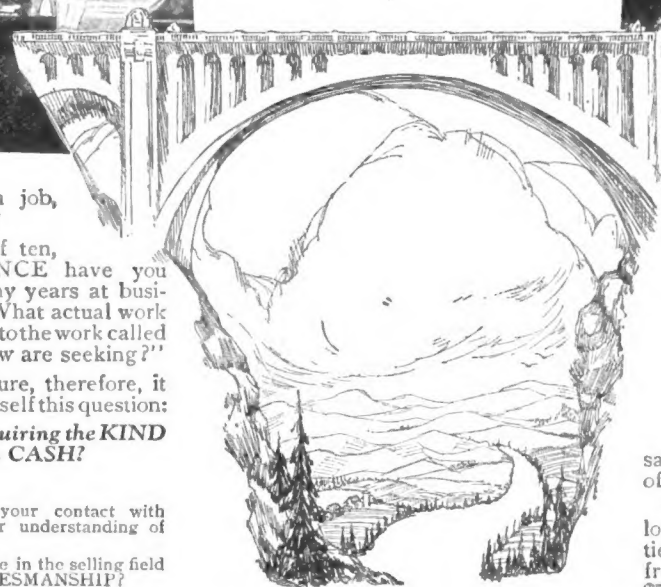
How the LaSalle Problem Method Bridges the Salary-Gap

—Why in three months' time alone as many as 1,193 LaSalle members reported definite salary-increases totalling $1,248,526, an average increase per man of 89 per cent!



When you apply for a job, what is the first question?

Why, nine times out of ten, it's "What EXPERIENCE have you had?" —Not "How many years at business," understand, but "What actual work have you performed similar to the work called for by the position you now are seeking?"

For the sake of your future, therefore, it will pay you well to ask yourself this question:

How rapidly are you acquiring the KIND of experience that you can CASH?

For instance—

Are you depending upon your contact with the head bookkeeper for your understanding of ACCOUNTANCY?

—Upon hit-or-miss experience in the selling field for your understanding of SALESMANSHIP?

—Upon the routine transactions of the shipping department for your understanding of TRAFFIC MANAGEMENT?

—Upon the occasional discussion of isolated contracts for your understanding of LAW?

—Upon your lunch-time chats with representatives of investment houses for your understanding of FINANCE?

Don't think, for a moment, that you can DODGE the facts which govern salary by saying that other men have come up from the ranks thru day-to-day experience alone. They have—but—business moves at a far swifter pace than it moved even ten years ago. The great demand is for youth and energy trained in the how and why.

Obviously, then, you cannot escape the following arresting challenge:

How—in the shortest possible time—can you PLUS your day-to-day experience with a practical working knowledge of the BEST ways for performing the special tasks of the higher positions?

During the past fourteen years more than 450,000 men have faced that question squarely—and have found their answer in the LASALLE PROBLEM METHOD.

* * *

When thousands and thousands of men in the United States and Canada (not to mention many hundreds in England, Australia, China and other foreign countries) choose the LaSalle Problem Method to speed their progress—when within only three months' time as many as 1,193 LaSalle members report definite salary-increases totalling $1,248,526—when the average increase so reported is 89 per cent—surely the LaSalle Problem Method must offer an unusually sound way of securing quickly the KIND of experience that can be CASHED.

It does. —And here is WHY:

You Learn By Doing

Suppose it were your privilege every day to sit in conference with the head of your firm. Suppose every day he were to lay before you in systematic order the various problems he is compelled to solve, and were to explain to you the principles by which he solves them. Suppose that one by one you were to WORK THOSE PROBLEMS OUT—returning to him every day for counsel and assistance—

Granted that privilege, surely your advancement would be faster—BY FAR—than that of the man who is compelled to pick up experience hit-or-miss.

Under the LaSalle Problem Method you pursue, to all intents and purposes, that identical plan. You advance by SOLVING PROBLEMS.

Only—instead of having at your command the counsel of a single individual—your Chief—you have back of you the organized experience of the largest business training institution in the world, the authoritative findings of scores of able specialists, the actual procedure of the most successful business houses in America.

Thus—instead of fumbling and blundering and maybe losing a job now and then, you are COACHED in the solving of the very problems you must face in the higher positions. Step by step, you work them out for yourself—until, at the conclusion of your training in a given branch of business, you have at your finger-tips the KIND of experience that men are willing and glad to pay real money for.

In view of that opportunity, is it not folly to let the days and weeks and months slip away from you, when by taking thought you can put yourself in line for a high-salaried executive position?

The Reward of Training

Between the routine job and the responsible executive position there is a salary-gap which is separating thousands of men from financial independence.

On the one side of the gap are long hours, low pay, little more than the bare necessities. On the other side are comparative freedom from supervision, an income of $5,000 a year or better, the comforts and luxuries of life.

The only routes that can take a man across the gap are all of them marked "EXPERIENCE"—and of all those routes the only one that BRIDGES the gap is—HOME-STUDY TRAINING.

If you are intent to save the years you otherwise would waste, you cannot afford to turn away from that bridge—you cannot, indeed, afford even to turn this page—until you have taken the necessary steps to FIND the bridge and USE it!

The coupon just below this text will bring you a fascinating book—the story of how one man took this shorter route to success and earned for himself "Ten Years' Promotion in One." "Get this book," said a prominent Chicago executive, "even if you have to pay five dollars for it." LaSalle will send it to you FREE. With this book LaSalle will send you also complete information regarding the training you are interested in, together with details of its convenient payment plan.

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Watch for These Departments in the

MOTOR CAMPER & TOURIST

THE OPEN ROAD

One of the most valuable departments in this magazine is "THE OPEN ROAD." Each month, in this department, are shown different important highways and routes in the United States in map form so that in a short time anyone can become familiar with the best highways in the country.

CAMPSITES

This department is for the man who wants to camp in the outdoors on his motor trip. It shows the number and location of campsites in every state in the Union.

PARKS

One of the most desirable features of touring in America is the prevalence of wonderful, scenic parks, especially the great National Parks. There is a special department for these places.

RADIO IN CAMP

This is an unusual department for the man who is interested in Radio as a pleasant adjunct to the motor trip. It is compiled by a staff of the foremost Radio Experts in America.

ROADSIDE REPAIRS

Every autoist will welcome this department as a friend in need when the car breaks down on the road. Every line in it is of value to every motorist.

AROUND THE CAMP-FIRE

New and interesting things that come up from day to day and are of value to the motor traveller are in this department. It is a section of the book in which the reader always feels a personal interest.

NEW ACCESSORIES

A department for the Motor Car in which every new and worthy accessory of value to the Motor Camper and Tourist is detailed.

Then there are many feature articles written by men who have travelled everywhere in America. They tell of their trips and experiences and give many valuable hints on what to take on a trip, what to look out for and how to get the utmost in pleasure from the trip.

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The Greatest Sport in the World

SEEING AMERICA In Your Car

You don't know what you are missing. The idea this summer is to take that vacation of yours in your car. Don't leave it in the garage. Save hotel bills and all those heavy travelling expenses by taking your car with you.

And don't forget those happy week-ends in your own state—let the car take you.

MOTOR CAMPER & TOURIST, the Motor Tourist's magazine, tells you where you can go, how to make the trip at a minimum expense, what roads to travel and what to see on the trip.

MOTOR CAMPER & TOURIST is edited by H. Gernsback, Editor of Radio News, Science and Invention, and Practical Electrics.

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I Guarantee to fit You for $5000 ELECTRICAL JOBS or It Doesn't Cost You One Cent

As Chief Engineer of the famous S & H Electrical Works I know exactly what you need to make you a high-class, electrical expert, capable of earning from $65 to $200 a week. I will fit you at home, in a few weeks, for the big-money jobs. Experience unnecessary. S & H Employment Service free. Also unlimited advisory service—long after you have finished training for the high electrical jobs, and your own profitable business. S & H is backed by the Lincoln Institute of Technology.

FREE PROOF *That You Can Step Into These Electrical Jobs Quick This Amazing New Way*

Wanted

WHY take chances? You want to step quickly into the big-money field of electricity, where there are countless opportunities. Naturally you want only the latest approved method of home training — the method endorsed by leading electrical experts. The method that doesn't hesitate to guarantee its promise to you.

As chief engineer of the S & H Engineering Co., I studied years upon the problem of making it possible for ambitious men who like electrical work to get the big-pay jobs without technical school or college education. I knew that every day the tragic shortage of technical experts hampered electrical progress. At last I discovered and copyrighted this remarkable Shop Type training in electricity, the biggest advance in 20 years in teaching electricity.

No Experience Needed

And now any man of average intelligence can step into these big-pay jobs. In your own home you can have the practical, actual shop type training. That's the secret of the amazing success of S & H graduates—I discovered how to apply practical training with the theory of electricity so that even men who have never finished grade school are graduating into salaries they never dreamed they could command. My great satisfaction is that I made it possible for men to step quickly into high positions of electricity—made long years of apprenticeship and small-pay toil in this great field unnecessary.

I Ask Only Twenty Weeks

This training is so plain, so simple, that many of my students graduate and enter the profession in only 20 weeks' time. And yet so thorough that S & H graduates are in constant demand because they are trained in every branch of electricity. No wonder electrical experts have hailed this common-sense, practical, result-proving training as a boon to the electrical profession—so sadly in need of well-trained men.

A Legal Binding Guarantee

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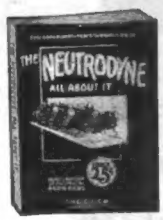

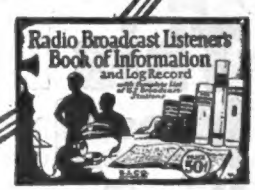

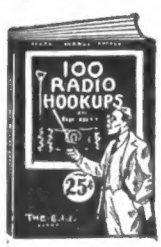

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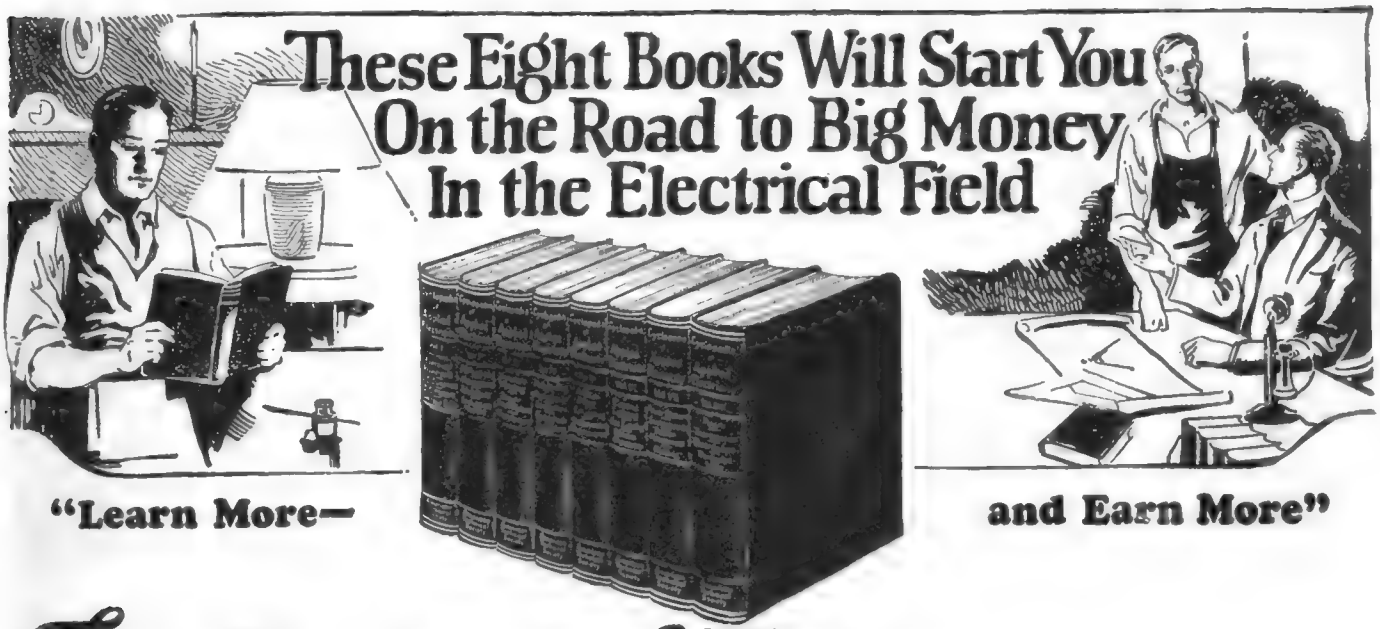

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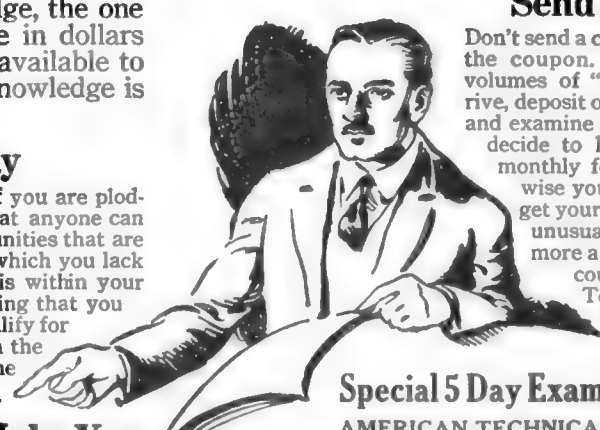

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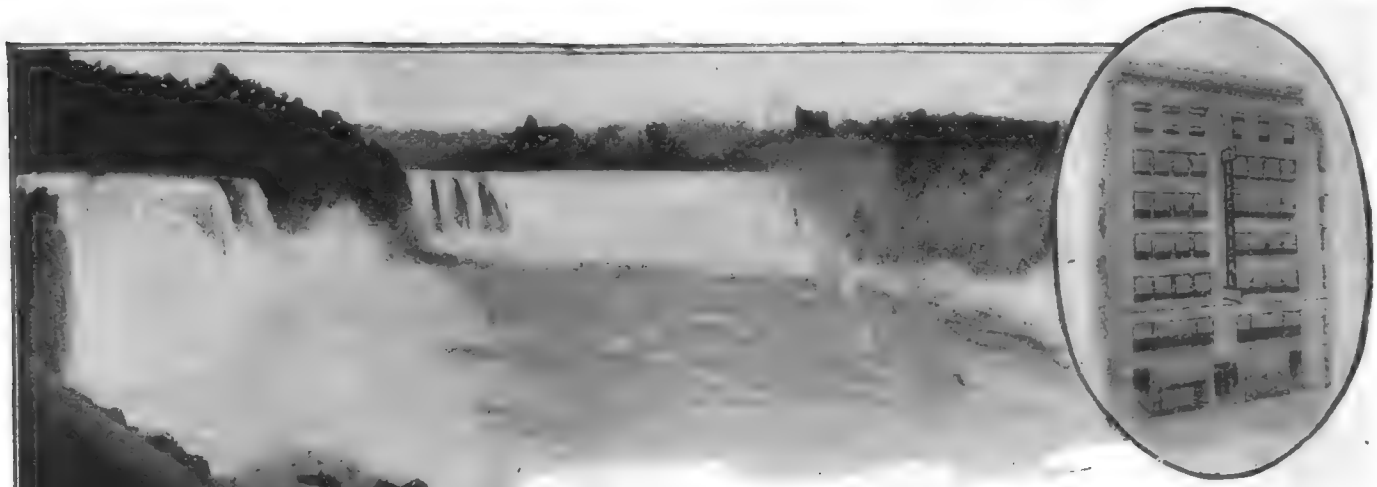

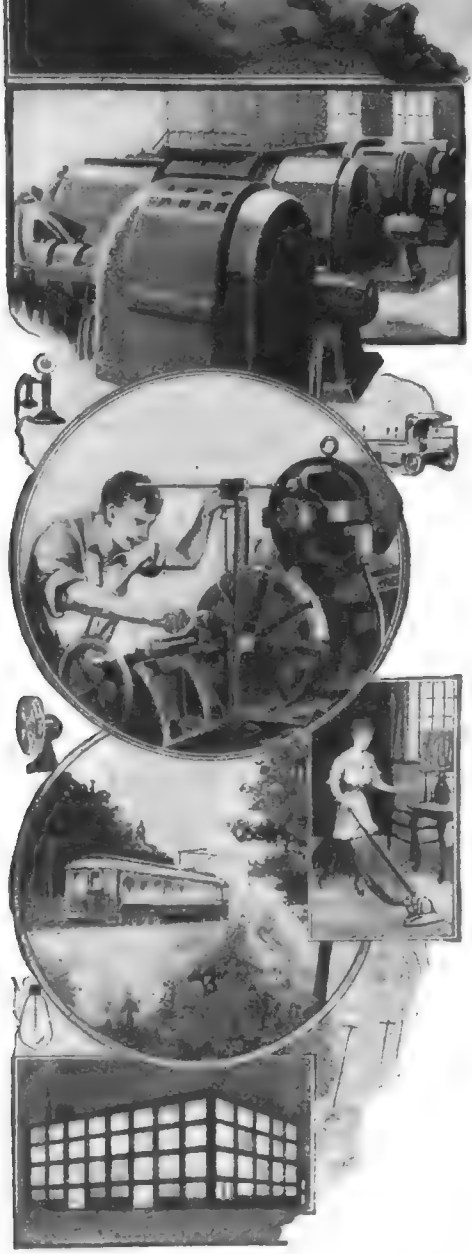

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Volume XII
Whole No. 137

Science and Invention

SEPT., 1924
No. 5

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Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

Important Radio Inventions

By HUGO GERNSBACK

DURING the past few months two very important radio inventions have been made which will revolutionize the radio art during the next decade. As a rule radio inventions are only improvements on existing devices. It is seldom indeed that something big comes along that causes a stir in the radio world. Nevertheless, this actually happened not only once, but twice, during the past few months.

The inventions to which we refer are now known as the *Solodyne* principle and the *Crystodyne* principle.

The Solodyne principle is the invention of Messrs. G. W. Downing and K. D. Rogers, two young English technicians. The invention, in a few words, does away with the "B" battery, as well as *all* high tension current. The tubes are supplied only with the "A" battery current, no other source of current supply being used. It is a well known fact, known only too well to every radio fan, that about 80 per cent of the vacuum tubes in use are *blown out* when accidentally shorted with the "B" battery. Only some 20 per cent of the tubes wear out naturally. By means of the Solodyne principle this is done away with entirely. Not only that, but in radio outfits embodying the Solodyne circuit, operation of the set becomes extremely quiet.

I BELIEVE

that television by Radio will be in everyday use within the next ten years.

Everyone knows, particularly when operating a loud speaker, that there is always a certain roar that comes from the horn even when no one is speaking or singing from the particular station to which one is listening. This extraneous sound is done away with entirely in the Solodyne outfit. Supreme quiet reigns.

The music or voice comes on with a startling suddenness and is usually much clearer. While by means of the new Solodyne principle no greater distances are claimed, nor any other remarkable stunts, the mere fact that in a short time we will have radio sets without "B" batteries is in itself a great advance.

Also when receiving long distance signals, the "B" batteries usually give enough additional noise in the head phones or loud speaker to kill the sounds of the far distant voice or music, which is not the case in a Solodyne circuit. Furthermore, static seems to be reduced somewhat as it is no longer amplified by the "B" batteries.

I BELIEVE

that the man who has not built and worked a radio set, missed one of the greatest thrills of the century.

The second invention, which undoubtedly is more important than the first one, has been termed the *Crystodyne* principle. This is the invention of a young Russian, Mr. O. V. Lossev. Mr. Lossev has taken the humble little crystal that we have used so many years as a detector only and has succeeded in making it oscillate. By means of this sensational discovery it is now possible to do anything and everything that the vacuum tube does. The crystal, which *must* be a combination of *zincite* and *steel contact*, now not only oscillates, but it can be used to detect, amplify and regenerate, just exactly as does a good vacuum tube. Not only that, but the crystal can also be used to transmit waves, the same as does the vacuum tube.

By means of a few pieces of zincite crystal, some resistances, a few coils of wire and a microphone, you can now own a wireless telephone that actually sends out your words into space. This has already been accomplished by means of a single crystal over a distance as great as three-quarters of a mile in Russia.

On the receiving end the tubes are entirely replaced by means of the zincite-steel detectors. Just as you now build a six tube super-heterodyne set, so will you be able in the near future to build a six crystal set. Not only that, but the Crystodyne circuits are very much simpler because only one battery is used to supply the power to the crystal. The circuits themselves are also very much simplified. There is less intricacy in the wiring and there are other obvious simplifications.

Important as these two inventions are, they are only at the present time in an experimental form. In no instance have they been perfected in such a way that they can leave the laboratory and enter into the commercial stage. The two inventions, however, have opened up a tremendous field for experimentation. Of this there can be no doubt. Particularly the Crystodyne principle, which adapts itself to the young man whose pocketbook is not too well supplied and who cannot afford to buy many vacuum tubes. To him a new world is opened up.

I BELIEVE

that even a fair understanding of Radio, is an education by itself.

Those contemplating buying radio outfits should thoroughly understand, however, that these two inventions will not affect seriously the radio trade for some years to come. It will take years before Solodyne outfits or Crystodyne outfits will appear upon the market.

Revolutionary inventions as a rule do not reach the public overnight. They take a long time before being translated into actual practice. It was so with the automobile, the telephone, the phonograph and hundreds of others. While important improvements have been made from time to time on these, still everyone remembers how orderly the progress was and how long it took to translate into actual practice. Present-day radio outfits, therefore, will be good for years to come.

Those interested in the Solodyne principle will find a full account of it in the August issue of RADIO NEWS, while the Crystodyne principle is fully discussed in the September issue of the same publication.

One of the very important features connected with the Crystodyne principle is that Mr. Lossev has, as far as we are informed, not taken out any patents on this epoch making invention. In other words, anyone could manufacture a future Crystodyne set without being interfered with, and without the necessity of paying a royalty or license on the particular set he chooses to manufacture.

This does not mean to say that everything will be rosy, for we may rest assured that in the years to come there will be many notable improvements and additional features that will be incorporated in the Crystodyne principle; and many of these will be patented.

One of the important things as yet to be discovered is a real fixed crystal detector. It is more or less difficult with the Crystodyne to-day to keep it adjusted, on account of the moving point, necessary to find a sensitive spot. Perhaps a fixed zincite—steel point crystal, enclosed in a vacuum may in time become a very powerful competitor to the vacuum tube.

Much work remains to be done in this direction and it offers the inventor a most lucrative field of endeavor right now.

SCIENCE AND INVENTION, beginning next month, will run a series of articles on these two new inventions, and will keep its readers informed of all new progress with them.

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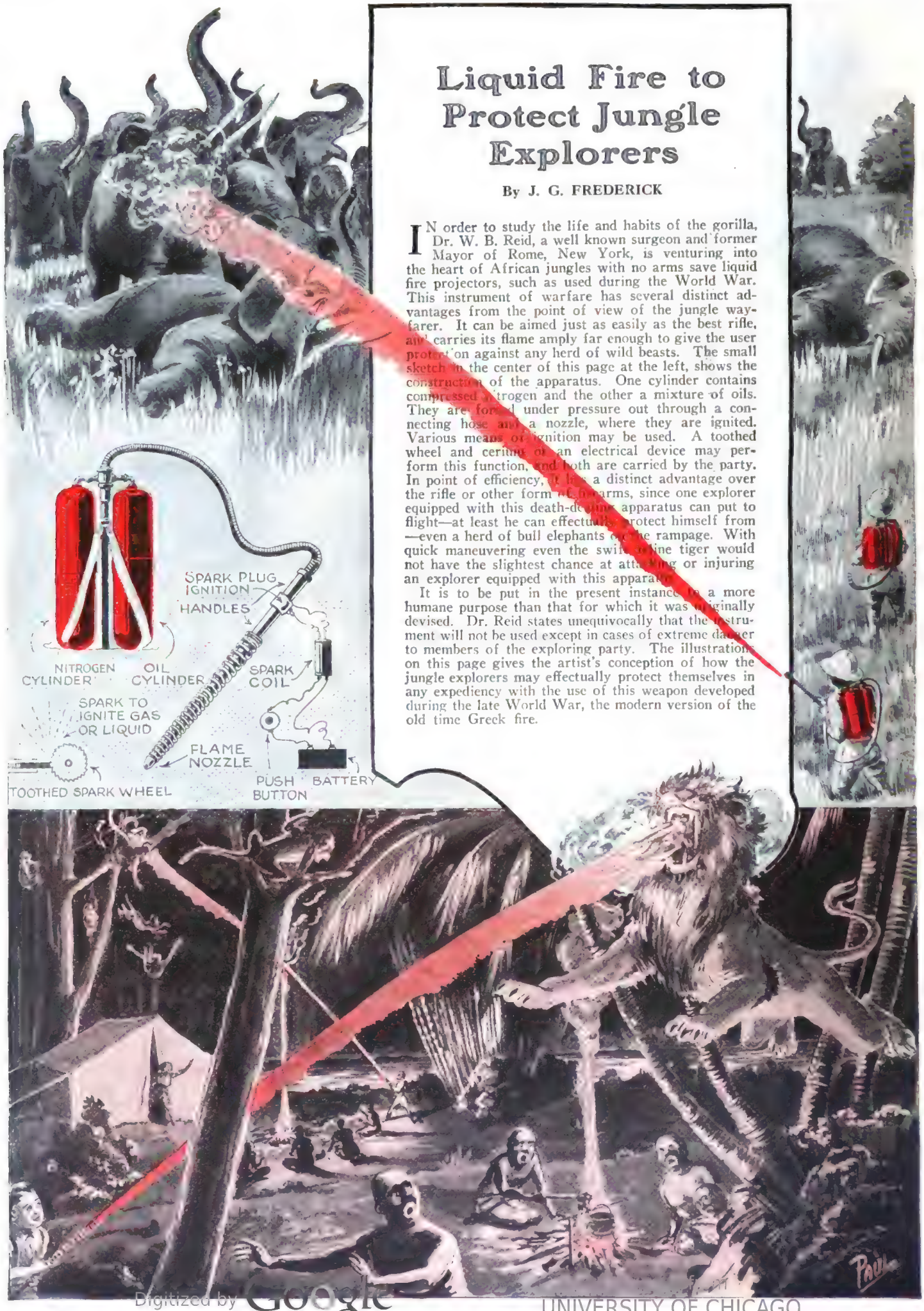
Liquid Fire to Protect Jungle Explorers

By J. G. FREDERICK

IN order to study the life and habits of the gorilla, Dr. W. B. Reid, a well known surgeon and former Mayor of Rome, New York, is venturing into the heart of African jungles with no arms save liquid fire projectors, such as used during the World War. This instrument of warfare has several distinct advantages from the point of view of the jungle wayfarer. It can be aimed just as easily as the best rifle, and carries its flame amply far enough to give the user protection against any herd of wild beasts. The small sketch in the center of this page at the left, shows the construction of the apparatus. One cylinder contains compressed nitrogen and the other a mixture of oils. They are forced under pressure out through a connecting hose and a nozzle, where they are ignited. Various means of ignition may be used. A toothed wheel and ceriuni or an electrical device may perform this function, and both are carried by the party. In point of efficiency, it has a distinct advantage over the rifle or other form of firearms, since one explorer equipped with this death-dealing apparatus can put to flight—at least he can effectually protect himself from—even a herd of bull elephants on the rampage. With quick maneuvering even the swift feline tiger would not have the slightest chance at attacking or injuring an explorer equipped with this apparatus.

It is to be put in the present instance to a more humane purpose than that for which it was originally devised. Dr. Reid states unequivocally that the instrument will not be used except in cases of extreme danger to members of the exploring party. The illustrations on this page gives the artist's conception of how the jungle explorers may effectually protect themselves in any expediency with the use of this weapon developed during the late World War, the modern version of the old time Greek fire.



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At Last! Real Wind Power

By C. A. OLDROYD, A. E.

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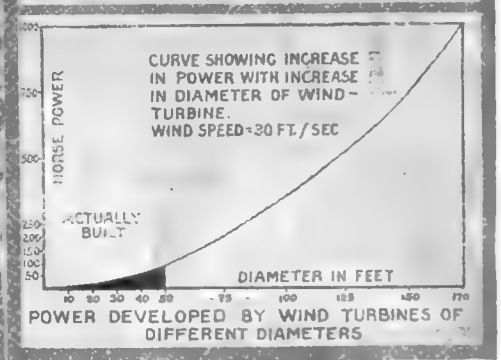
CURRENT FROM DYNAMO TO ELECTRIC PUMP
PIPE LINE FROM TANK TO WATER POWER STATION

The problem of centuries seems, at last, to be succumbing to the constant work of scientists. A Danish engineer has just brought forward the design of a wind electric plant which uses a tank of water as a method of storing the power taken from the wind. The wind pumps the water into the tank on the hill-top and when current is needed the water is allowed to flow through the turbines at the bottom of the hill, generating current.

Above and at the right are shown two views of the novel wind mill used by the Danish engineer. The new idea in wing construction will at once be noticed. The insert above and to the right shows a cross-section of one of the arms, which is very similar to the cross-section of an airplane wing. Only six arms are used to the unit for the sake of efficiency.

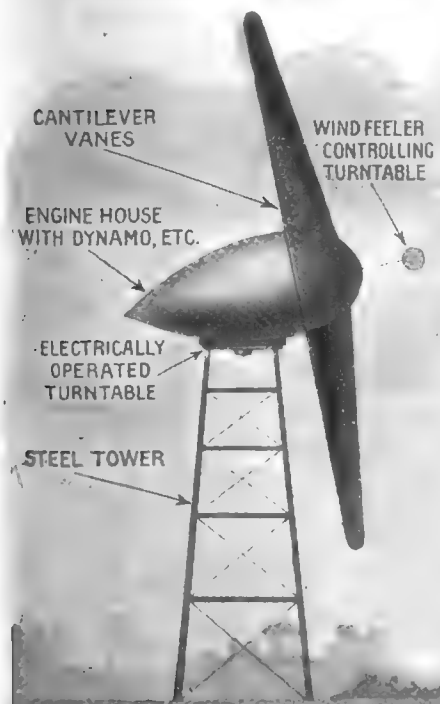
SECTION THROUGH THE VANE OF AN AGRICCO WIND TURBINE
NOTICE THE SIMILARITY WITH AN AEROPLANE WING SECTION

DIAGRAM OF WIND-WATER-ELECTRICITY SCHEME

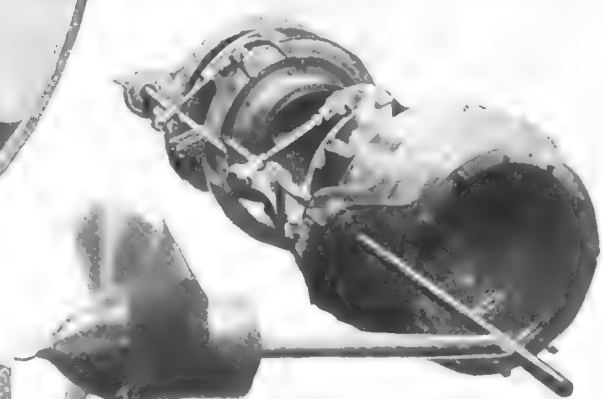

CURVE SHOWING INCREASE IN POWER WITH INCREASE IN DIAMETER OF WIND-TURBINE.
WIND SPEED=30 FT./SEC
HORSE POWER
ACTUALLY BUILT
DIAMETER IN FEET
10 20 30 40 50 75 100 125 150 175

POWER DEVELOPED BY WIND TURBINES OF DIFFERENT DIAMETERS

The curve immediately above shows the remarkable increase in horse-power as the diameter of the wings increase. Fifty feet is about the largest diameter mill that has been constructed to date. The larger the mills are made, the greater is the proportional increase in horse-power. Above the curve are shown the various transitions through which the power is carried in this system of developing electricity from the wind. The wind pumps the water through an electric pump to the top of the hill. The water is led from the tank to the turbines as needed, and the turbines drive generators, giving electric power for distribution to consumers.



Above is shown a more advanced engineering design giving a probable future form of the big wind engine. The blades are cantilever type with no wires or bracing struts exposed. A wind feeler controls the shift of the machine towards the wind. The blades are attached directly to the front part of the housing, which revolves with them. The rear of the housing contains an electric generator connected directly or through gears to the shaft. The whole affair is streamlined. The position of the machine is changed by an electrically driven turn-table which works automatically.



One of the most potent factors in the development of wind power is a new Danish turbine for use with water which revolves at a much higher speed than the older type, allowing direct connection between the turbine and the generator. The revolving unit as well as the fixed unit directly coupled to the generator is shown in the above illustration.

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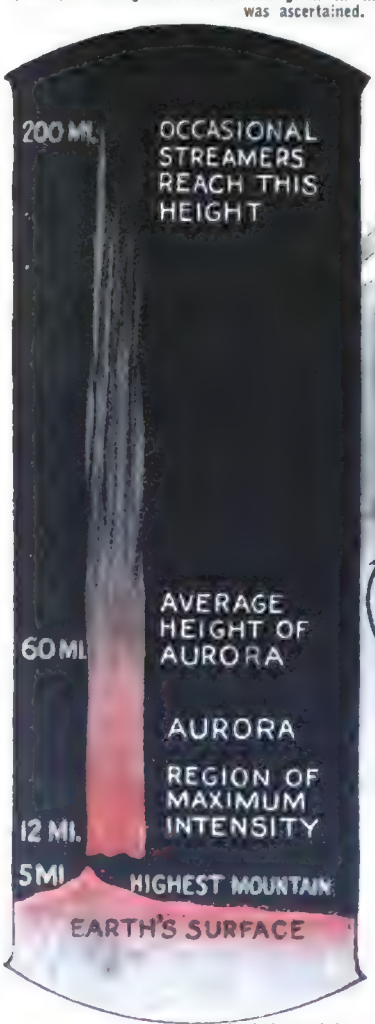
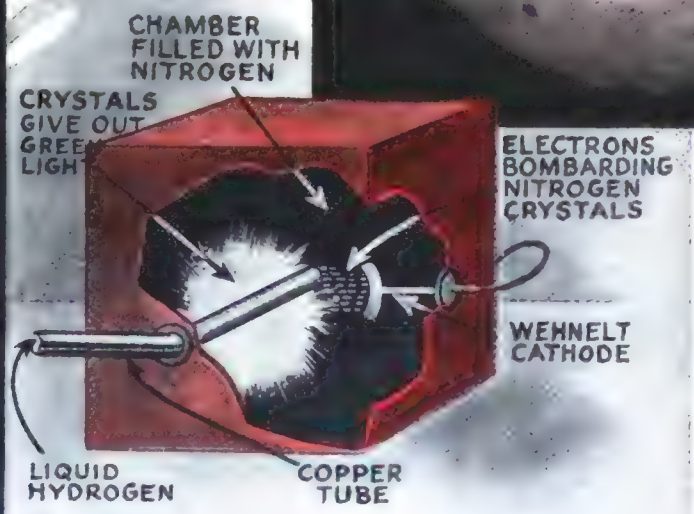
What Causes the Aurora Borealis?

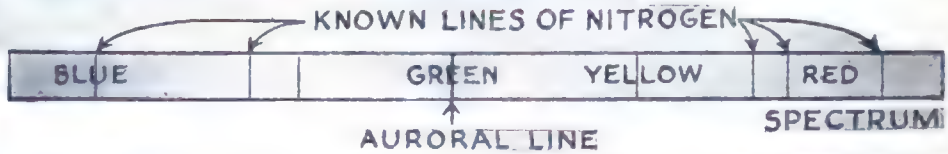
By DONALD H. MENZEL Ph.D.

Above is given a typical view of the famous aurora as it might appear in an extremely northern or southern latitude. It hangs about over the sky like the great folds of a multi-colored drapery. What causes it science has been wondering for years. There has been a constant watch kept on all celestial demonstrations which accompany it. The two telescopes and observatories illustrated in the above sketch show how one of the first investigations regarding the aurora was carried out. The two telescopes were pointed to different spots on the aurora, and through the angular measurements to these points, the height of the aurora given in the sketch immediately below was ascertained.





It was only recently that any even seemingly logical explanation for the existence of this great phenomenon was evolved. Prof. Vegard found in some investigations that the peculiar greenish hue of light given out almost constantly by the aurora could be identified with that due to ignited nitrogen. He decided that this demonstration was very similar to that observed in a Geissler tube. He then inferred, since all large demonstrations of aurora have been noticed in connection with sun spots and other solar disturbances, that in the upper atmosphere where extremely low temperatures obtain, nitrogen did not probably exist as a gas but rather as a solid or dust. From this observation he devised the apparatus shown at the left and described below.



After observing that sun spots such as that shown above in the center of the page were intimately connected with the aurora, and acting on the thesis that a powerful bombardment of electrons resulted from such solar disturbances, the apparatus above was built, which consisted of nitrogen deposited on the surface of a copper rod and a cathode. The solidification was effected by the use of liquid hydrogen for the reduction of temperature to the necessary point. The Wehnelt cathode was placed, across from the copper rod in the air exhaust chamber, and a high pressure electric circuit (voltages ranging from 200 to 750 volts were used) was connected to the cathode. Immed ately the same, greenish, hue, constantly evident in the aurora, was produced in the exhausted chamber. This led to the view that the bombardment of electrons from the sun striking solid or solidized nitrogen in the upper stratum of the atmosphere was the cause of this far-famed phenomenon.

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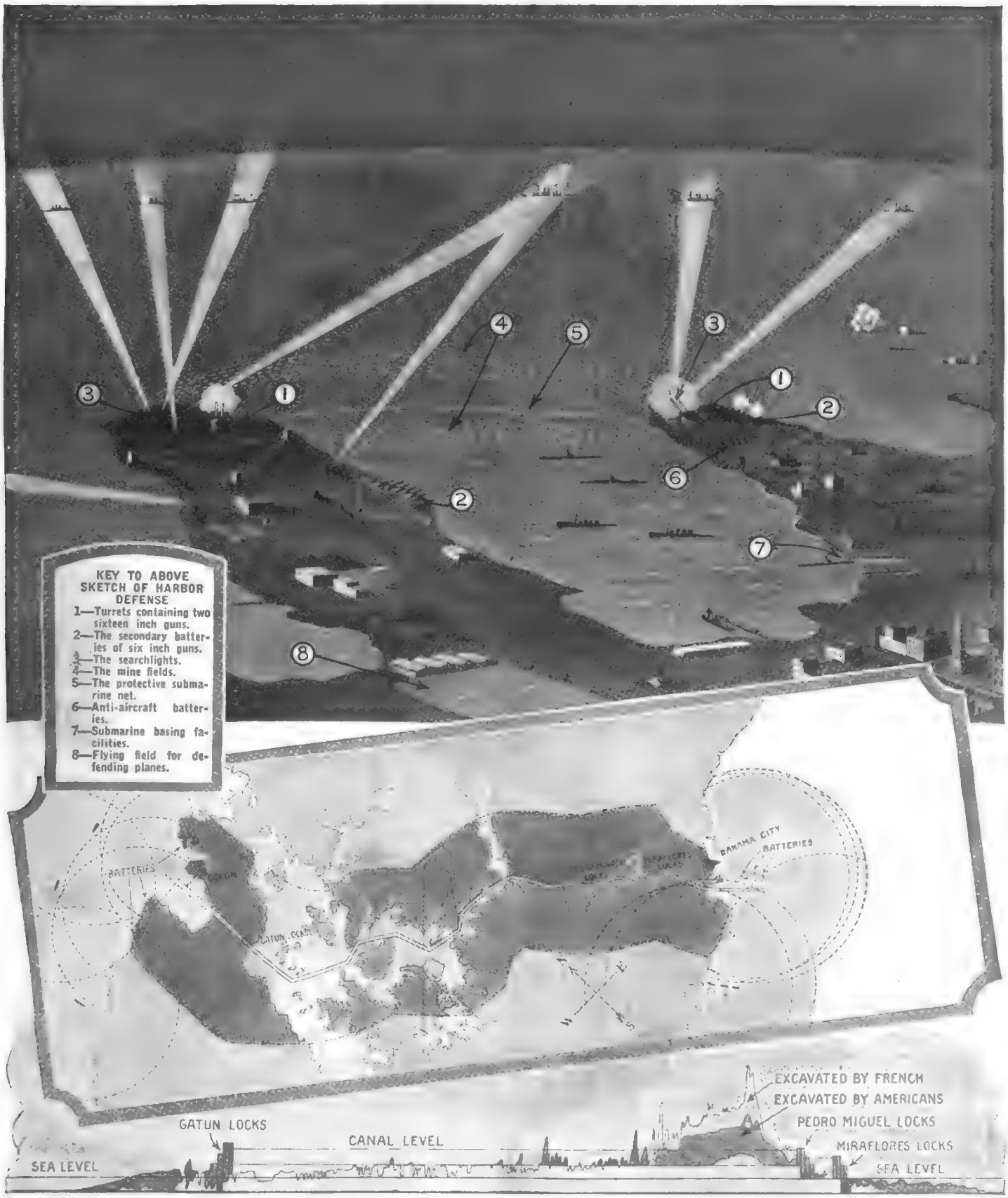
Can Panama Canal Be Defended?

By GRASER SCHORNSTHEIMER, Staff Naval Editor



AUTHORITIES have recently stated that the Panama Canal should be brought to sea level for the sake of fortification. However, the Panama Canal is a weak point in the national defense, because the ordnance and equipment at present installed are antiquated. The sketch at the top of the page with the key gives an idea of the procedure in a naval battle, when the forts are notified of the presence of enemy vessels near or within range. Searchlight batteries immediately seek out the vessels. The heaviest artillery is then turned on them and fire is opened. Small destroyers of the enemy fleet usually attempt to come in close, under cover of course, and fire at the searchlight batteries and other important units. The smoke screen very often finds its chief use at this point. Adequate airplane observation, however, makes the smoke screen worse than useless since the planes may observe the movements of the enemy's ships from above. Of course, the water immediately in front of the fortifications is protected from submarines and other small craft by mine fields and nets. In the center illustration is graphically shown how the old 12" and 14" calibre guns, which are now the chief supports of the canal fortifications, might be easily outdistanced by the larger guns and better armament of present day navies. The best point for perfect protection of a canal is not bringing it to sea level, but the installation of adequate artillery and perfection of the present fortresses. The cross-section shown at the bottom of the page gives a very clear idea of the huge amount of work that would be necessitated in bringing the canal to sea level.

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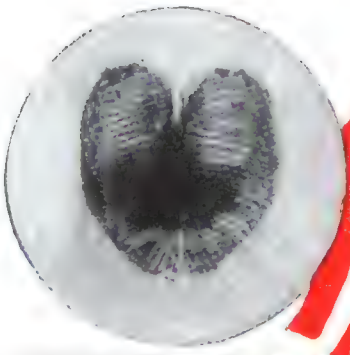
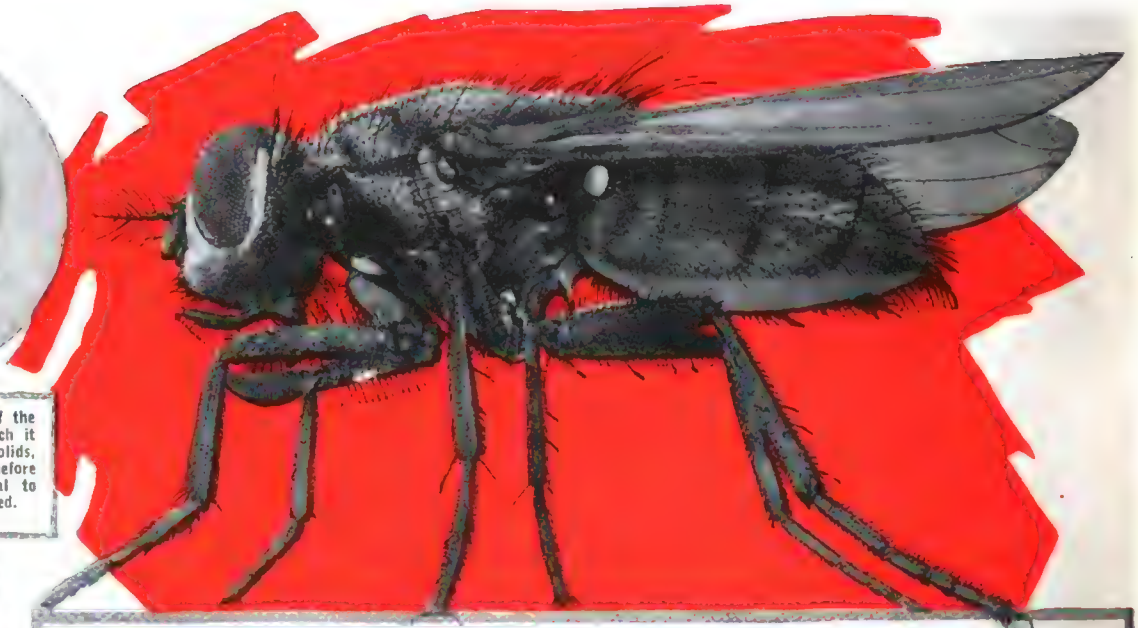
The Dangerous House Fly

Methods of Combatting This Greatest of Germ Carriers.

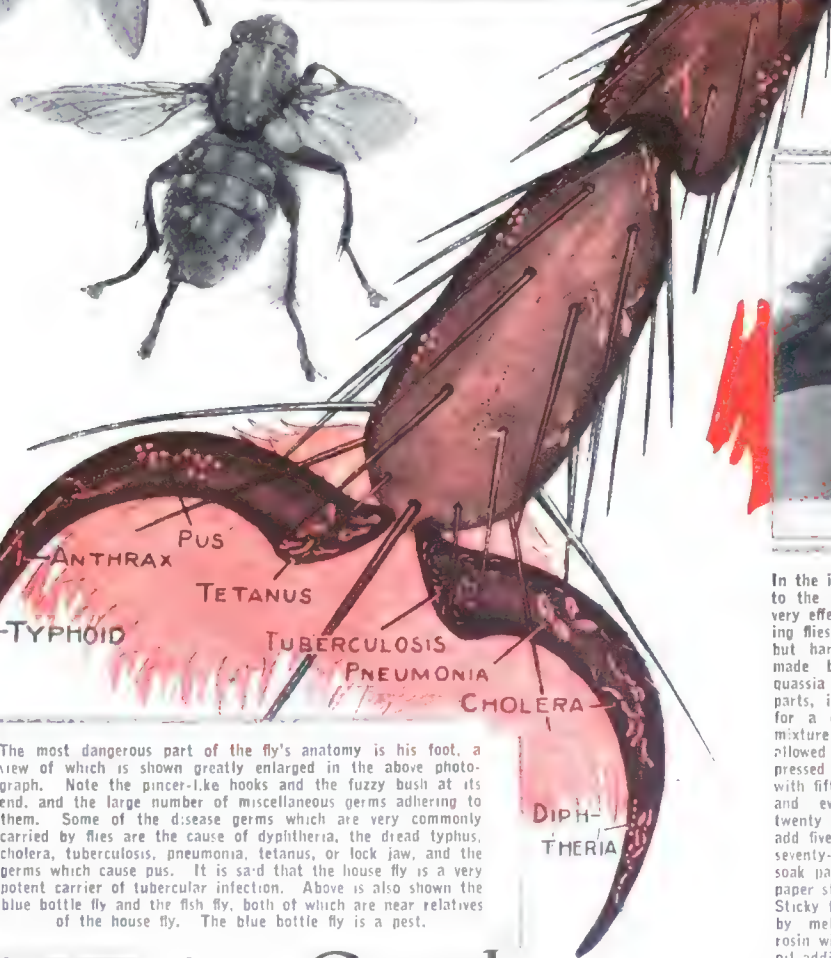
By DR. ERNEST BADE



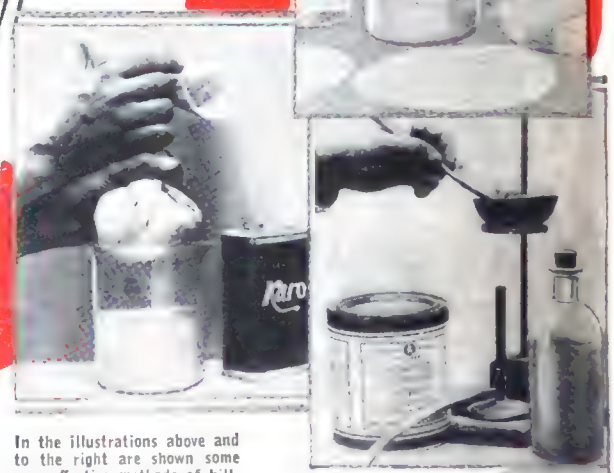
Above is shown a bottom view of the house fly's proboscis through which it takes food. Incapable of eating solids, the fly dissolves them in saliva before eating. Since the fly is partial to liquid foods, keep them covered.



Although the house fly in itself is harmless, its ability as a germ carrier for contagious diseases makes it one of the most feared pests of modern times. The picture above (by courtesy of the American Museum of Natural History) is of such magnitude as to give us a close acquaintance with the adult fly. Since it makes food of all sorts of garbage, offal and waste, and shortly after secures nourishment from the food in shops and in our homes, it is logical that the germs which infest the waste matter will find their paths to the food we eat, and consequently to our bodies, through the feet, legs, body and proboscis of the fly as a carrier. An added danger is that the fly considers milk one of its choicest foods and since baby also makes it a large part of his sustenance, it is therefore very necessary that particular care be taken to keep flies away from milk. Open wounds on cattle or men are also a very dangerous spot for infection from flies, since germs may be carried directly into the blood stream in this way.



The most dangerous part of the fly's anatomy is his foot, a view of which is shown greatly enlarged in the above photograph. Note the pincer-like hooks and the fuzzy bush at its end, and the large number of miscellaneous germs adhering to them. Some of the disease germs which are very commonly carried by flies are the cause of dyphtheria, the dread typhus, cholera, tuberculosis, pneumonia, tetanus, or lock jaw, and the germs which cause pus. It is said that the house fly is a very potent carrier of tubercular infection. Above is also shown the blue bottle fly and the fish fly, both of which are near relatives of the house fly. The blue bottle fly is a pest.



In the illustrations above and to the right are shown some very effective methods of killing flies. An extremely good but harmless poison can be made by soaking chips of quassia wood, one hundred parts, in fifty parts of water for a day, after which the mixture is boiled half an hour, allowed to stand another day pressed through a rag, mixed with fifteen parts of molasses and evaporated until only twenty parts remain. Then add five parts of alcohol and seventy-five parts of water, soak paper in it, and let the paper stand in a dish of water. Sticky fly paper may be made by melting three parts of rosin with one part of linseed oil adding one part of honey. Paint on paper while hot.

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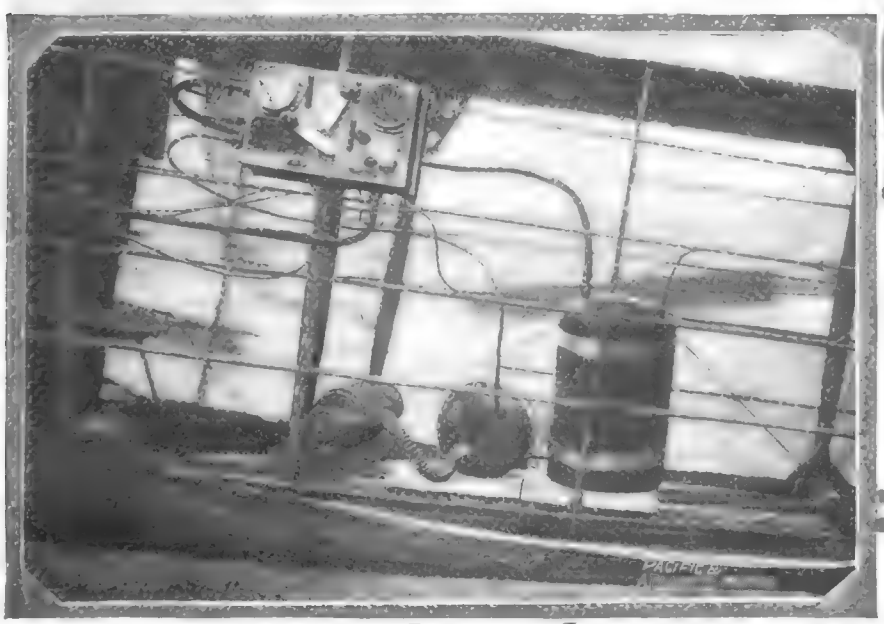
Widely Diversified Applications of Science

Behold Signor Miguel Juan, a Spanish genius with his one-man jazz guitar. This unique instrument is really fourteen different ones all in one, and when properly played is said to give the effect of a whole jazz band. The photo shows the Signor playing the four mouth organs.

Ever hear of the drunkenness detector? Well, here it is, ladies and gentlemen, but in this case the patient is not supposed to have imbibed something stronger than one-half of 1%. This new instrument of science, known as the "metabulur," is shown in use in a Boston hospital in an effort to acertain what makes people fat. In the photograph we see Miss Louise Harris operating the mechanical breath-sniffer at the Boston City Hospital, measuring the various amounts of different gases in the patient's breath for the purpose aforementioned.

Fire in an airplane or dirigible is one of the most dreaded catastrophes and aviators everywhere will no doubt be interested in the latest safety device shown below, which is nothing less than an automatic fire extinguisher for aircraft. If flames break out or an undue temperature rise takes place at any point about the plane, where suitable temperature rise detectors are placed, the fire extinguishing medium, which may be liquid or gas, is liberated at these points, quickly snuffing out the fire.



The twelve year old astronomer, Master Louis Cantenot of Dijon, France, has built the intricate apparatus shown above, which device shows in a clear manner the movement of the planets. This very interesting instrument is the result of Louis' deep study of the subject, together with his personal observations of the movements of the planets and stars in the heavens. He constructed this apparatus with the aid of a toy Meccano set, an electric lamp and socket, together with a motor of an electric fan. The young astronomy student's model operates from the electric light current in his home and works exactly on time; the earth rotating once in 24 hours, etc. A miniature globe such as those bought in a map shop represents the earth, and the electric lamp with its reflector takes the place of the sun. The gear wheels to be found with the toy building sets supply the necessary parts for giving the correct time movement to the whole affair.

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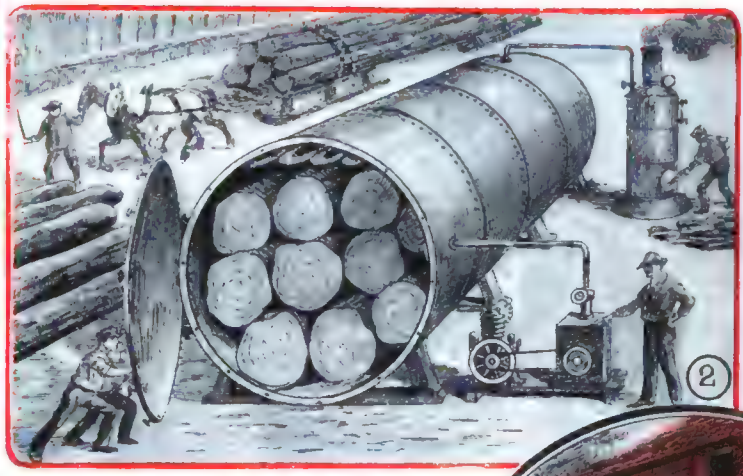
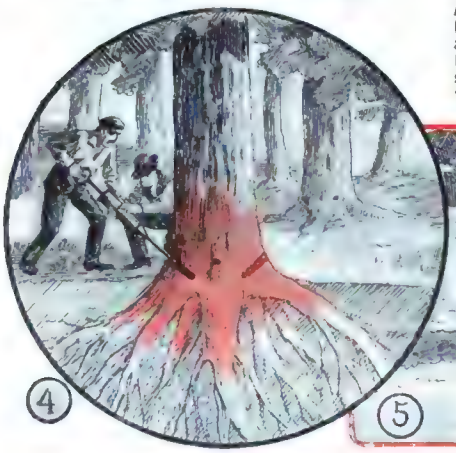
Advances in Lumbering

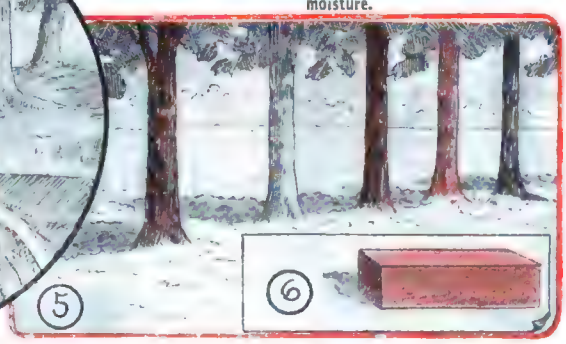
Below at 4 we have the latest development in dyeing wood wherein, by a process newly discovered, the whole fibre is colored while the tree is still growing. The dye is injected as shown, and within two days the process of sap absorption colors the whole tree.



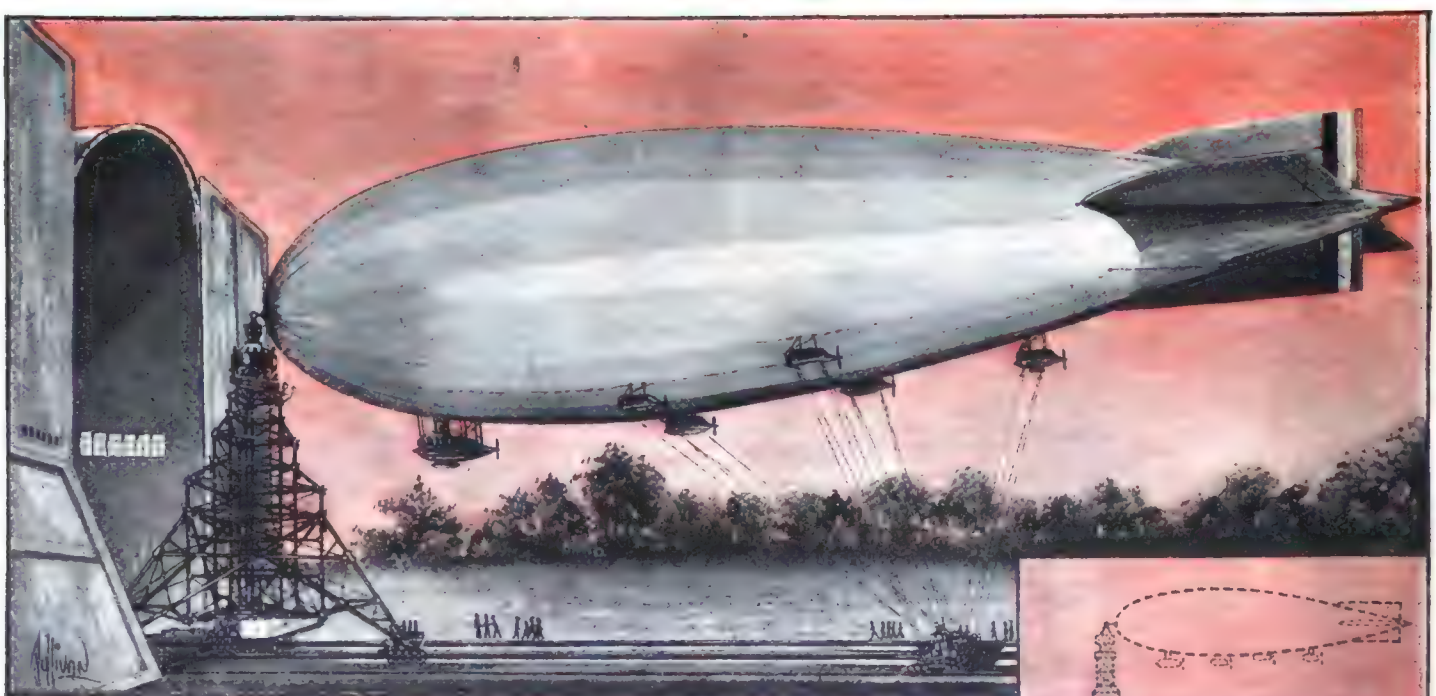
Above is shown the new vacuum process of drying lumber. Recent experiments in Sweden have shown this process capable of delivering thoroughly dried wood, ready for the builder's use, three days after the tree is cut from the stump. The logs are enclosed in an air-tight casing, and the exhaustion of air from the casing quickly removes all moisture.

The two recent advances in the lumbering trade, shown on this page, bid fair to have a far reaching effect in the near future. The automatic drying process using vacuum, shown in the first two illustrations, will save thousands of dollars and months of time in getting lumber to the market. Although the dyed trees shown in the bottom illustrations will give wonderful decorative effects, they will still be painted with varnish for protection from weather.





Collapsible Dirigible Mast



PRACTICALLY all the great accidents in connection with dirigibles have occurred while mooring them, since the slightest breeze will swing the ship against the hangar, tearing the bag and precipitating an explosion. The mooring mast shown in the above illustration is designed to obviate future accidents of this type. The mast is built in four sections and, when extended, moors the ship in the air. To place the vessel in the hangar, it is only necessary to drop the mast as shown, drop hawsers from various parts of the ship to the car seen in the rear of the illustration, pull the ship down and move the collapsible mast and the rear car into the hangar with the ship in tow, as both the mast and the car run along tracks. This idea is that of Mr. Wm. P. Sullivan.—Ernest Brennecke.

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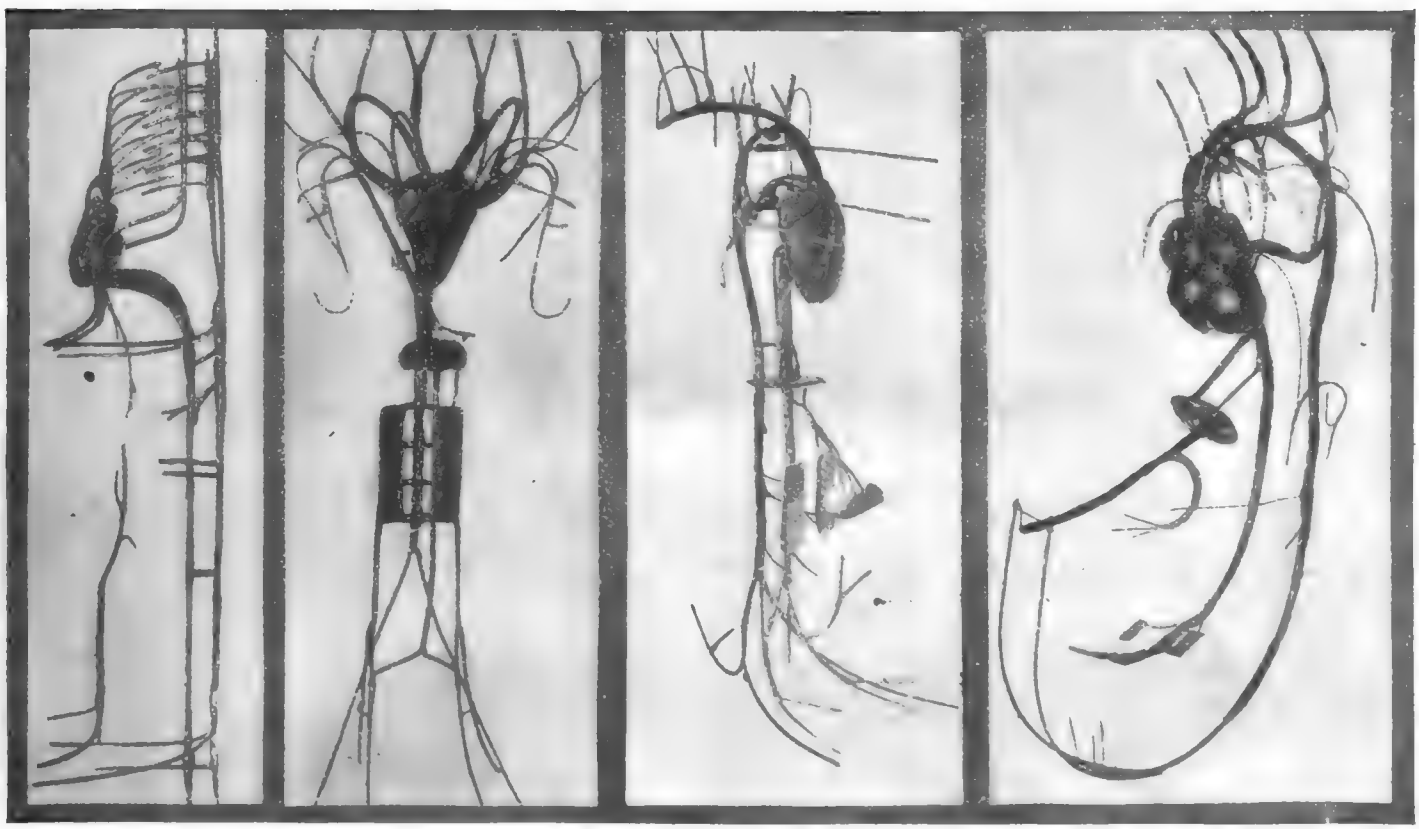
Cigar Lighter and Help for Autoists

Matches Used Instead of Liquid in Novel Lighter

In the two photographs at the left are shown the latest invention of a Frenchman, designed for the more complete pleasure of the smoker who is more or less an Epicurian. Many smokers do not like the flavor of a gasoline flame found in the automatic cigar lighters, so the ingenious Frenchman has designed the lighter shown, which has all the advantages of the mechanical device with none of its inconveniences. By simply pushing a small plug at the bottom of the box a match is forced up, lighted and held in place for the smoker. Regular safety matches are used to charge the lighter. At the right is shown the latest method employed to keep cars from freezing in cold weather. It consists of nothing more than a small lamp placed between the front of the motor and the radiator. In cold weather it is turned on whenever the car stands with the motor dead.—L. Fournier.

Blood Circulation System Models



In the illustrations above are shown several models, constructed of gypsum and wires by the famous German technician, Miss Agnes Erfurt of the University of Frankfurt, of the blood circulatory systems of a number of animals and fishes. As shown above, small wires are used as the foundation upon which to build the models. Upon these small wires the gypsum is placed in such shape and size as to conform to the exact dimensions of the original or in a certain fixed relation thereto. Each part of the system is colored so that it may be more easily traced out by the student. Left to right the models show: (1) Blood circulation of the shark. (2) Model of the blood circulation of a frog (3) Model of the circulation of blood in a rabbit. (4) Model of the human placental blood circulation after a natural preparation by Professor Hertwig.—Dr. Albert Neuberger.

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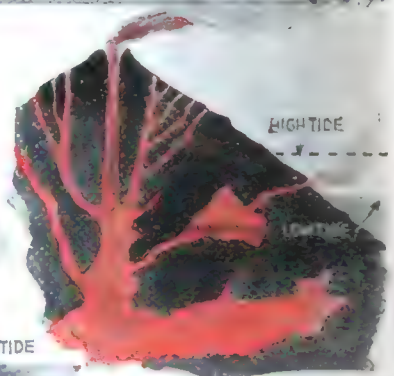
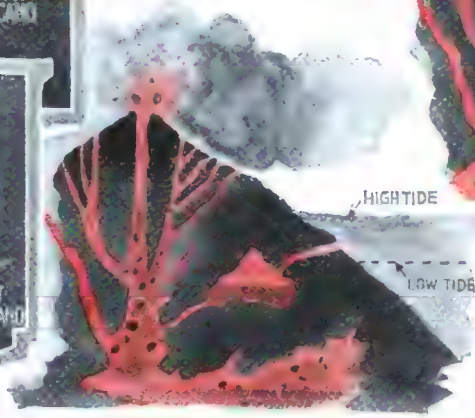
Flyers Skim Top of Hawaiian Volcano

By LT. C. P. McDARMENT

Above is Lieutenant R. C. Wriston and Sergeant R. L. Agnew of the U. S. Air Service, with the camera and plane which they used in making the pictures and investigations given here. They flew with all possible speed.

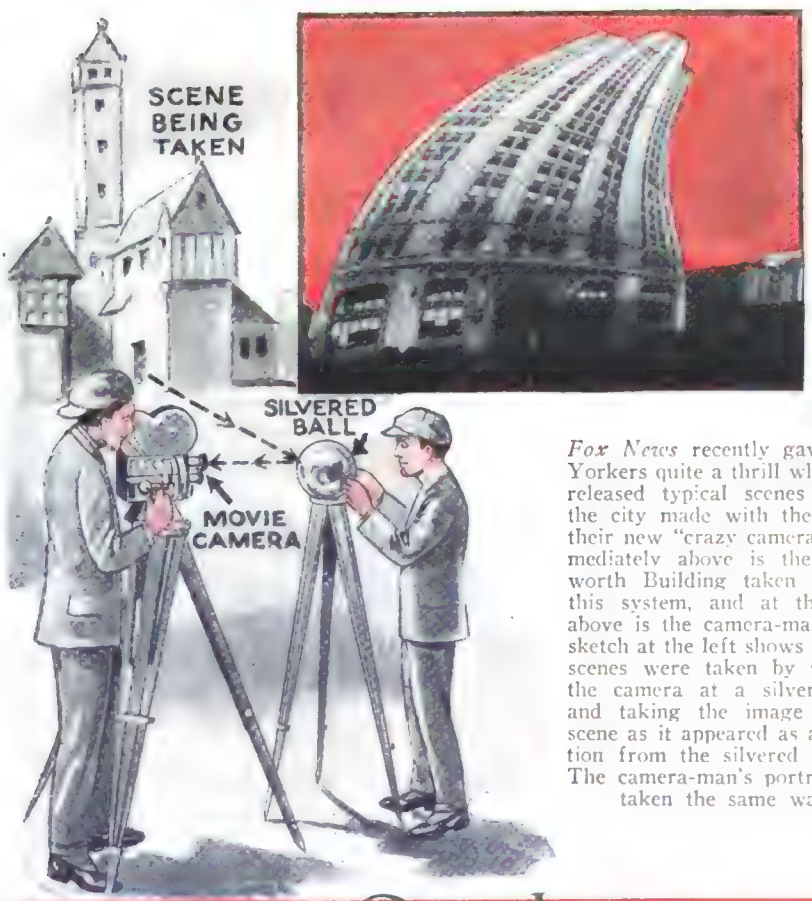
The top of Kilauea is one flaming, boiling mass of molten rock. In the very center there is a cone of actual incandescent rock, which boils up and recedes, according to the pictures and investigations made by two U. S. Army flyers; these movements follow closely the tides. The flyers skimmed across just fifty feet above the crater.



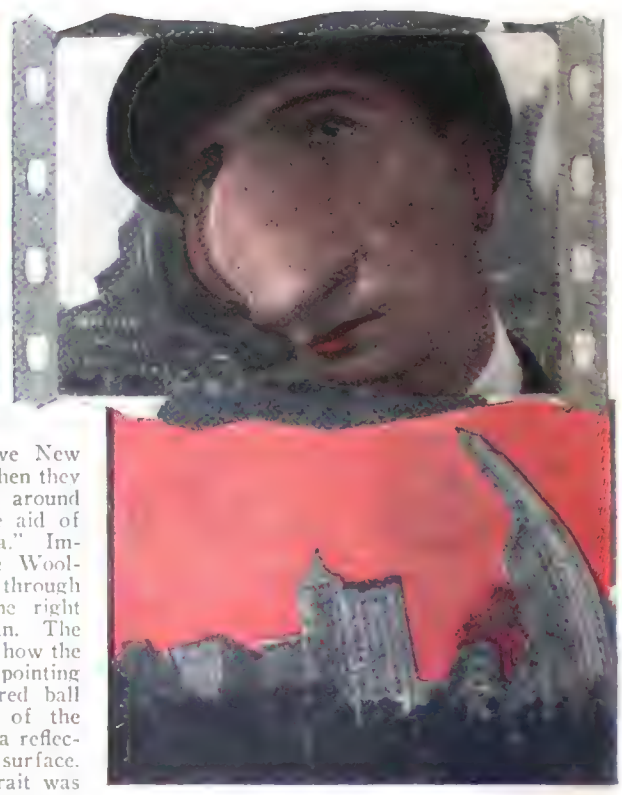


Since the cone was found to rise and fall according to tidal movements, it was decided that some such system as that detailed in the sketch above and to the left must affect the volcano. At high tide, water seeps in to a crevice, forming steam and pressure, causing the eruption. At low tide the pressure is released.
—Photos U. S. Air Service.

New York Goes On a Spree



Fox News recently gave New Yorkers quite a thrill when they released typical scenes around the city made with the aid of their new "crazy camera." Immediately above is the Woolworth Building taken through this system, and at the right above is the camera-man. The sketch at the left shows how the scenes were taken by pointing the camera at a silvered ball and taking the image of the scene as it appeared as a reflection from the silvered surface. The camera-man's portrait was taken the same way.



Above is shown a view taken near the City Hall, New York, with the Woolworth Building in the background. All sorts of distorted scenes with moving cars, people and trucks were taken with the aid of this camera, and proved exceedingly amusing.

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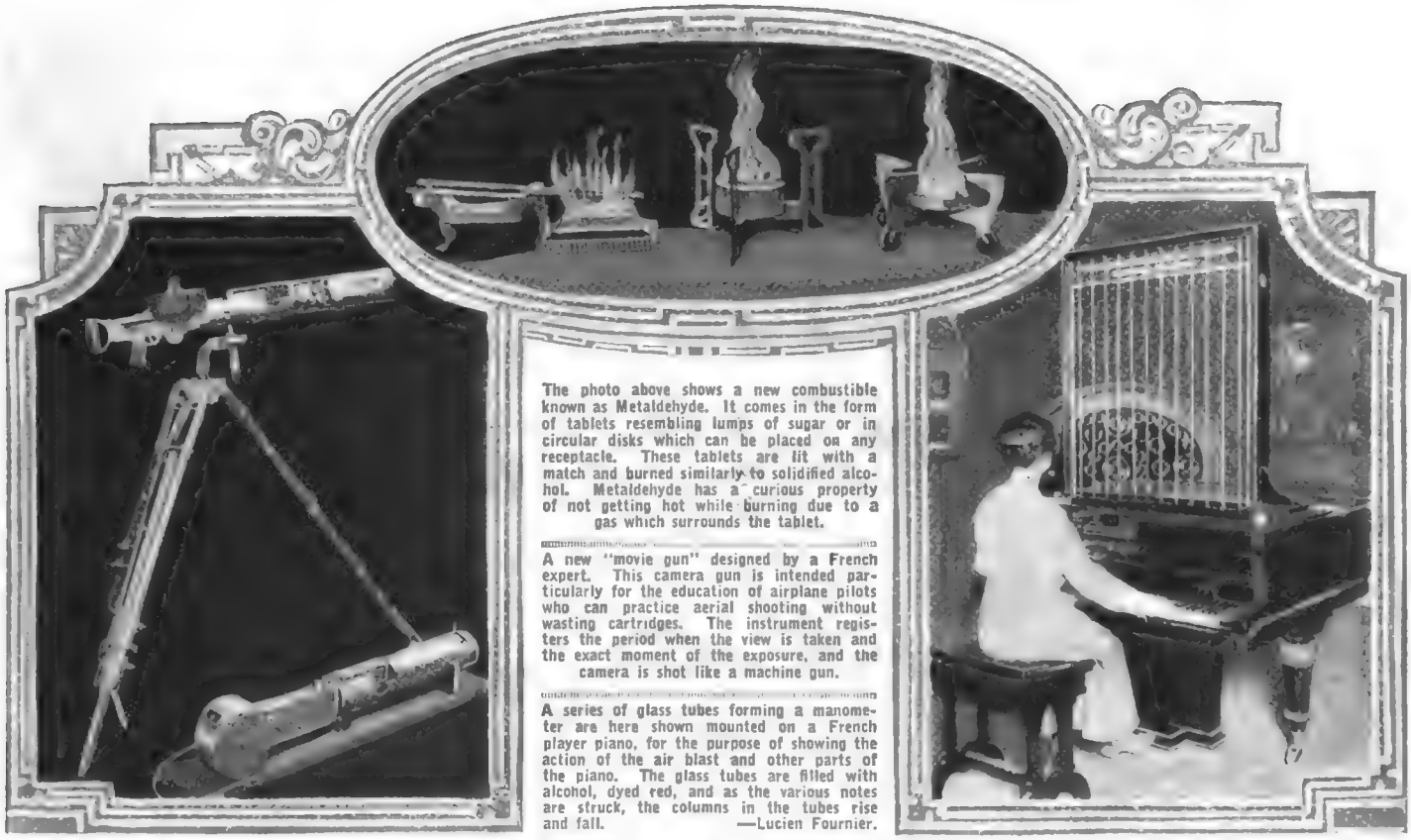
European Advances in Science

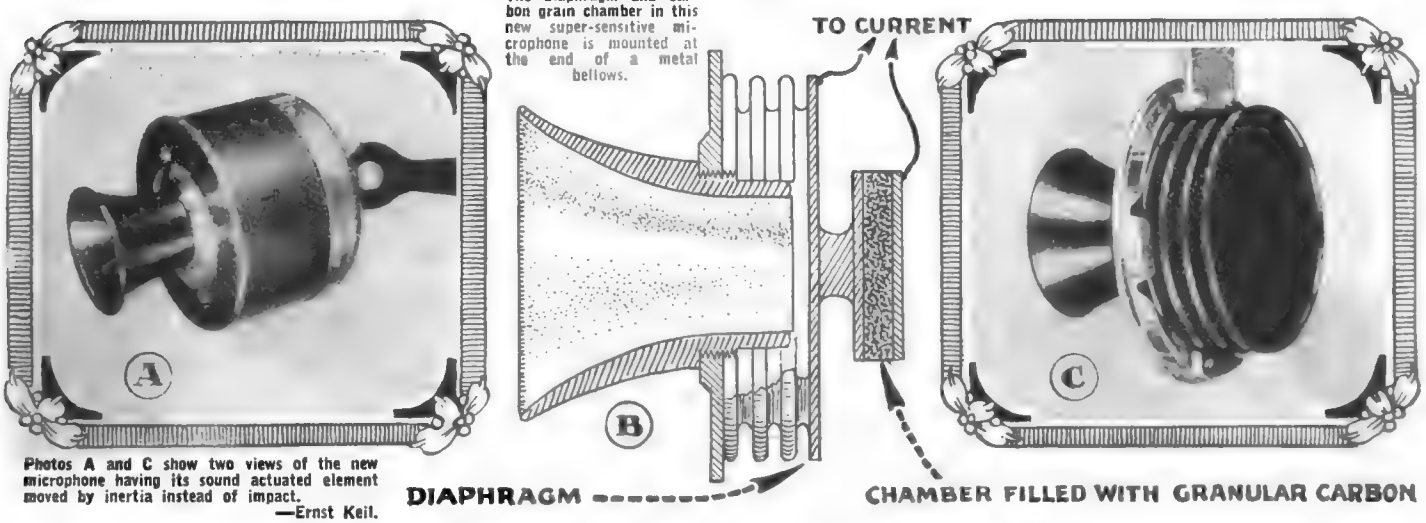


The photo above shows a new combustible known as Metaldehyde. It comes in the form of tablets resembling lumps of sugar or in circular disks which can be placed on any receptacle. These tablets are lit with a match and burned similarly to solidified alcohol. Metaldehyde has a curious property of not getting hot while burning due to a gas which surrounds the tablet.

A new "movie gun" designed by a French expert. This camera gun is intended particularly for the education of airplane pilots who can practice aerial shooting without wasting cartridges. The instrument registers the period when the view is taken and the exact moment of the exposure, and the camera is shot like a machine gun.

A series of glass tubes forming a manometer are here shown mounted on a French player piano, for the purpose of showing the action of the air blast and other parts of the piano. The glass tubes are filled with alcohol, dyed red, and as the various notes are struck, the columns in the tubes rise and fall. —Lucien Fournier.

A Super-Sensitive Microphone

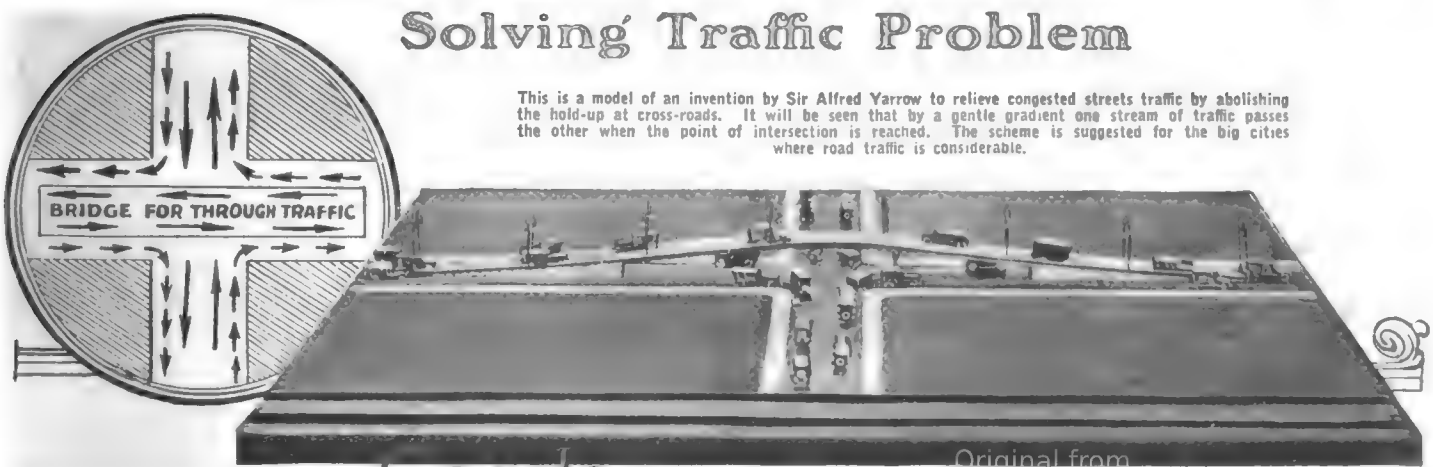


The diaphragm and carbon grain chamber in this new super-sensitive microphone is mounted at the end of a metal bellows.

Photos A and C show two views of the new microphone having its sound actuated element moved by inertia instead of impact. —Ernst Keil.

Solving Traffic Problem

This is a model of an invention by Sir Alfred Yarrow to relieve congested streets traffic by abolishing the hold-up at cross-roads. It will be seen that by a gentle gradient one stream of traffic passes the other when the point of intersection is reached. The scheme is suggested for the big cities where road traffic is considerable.



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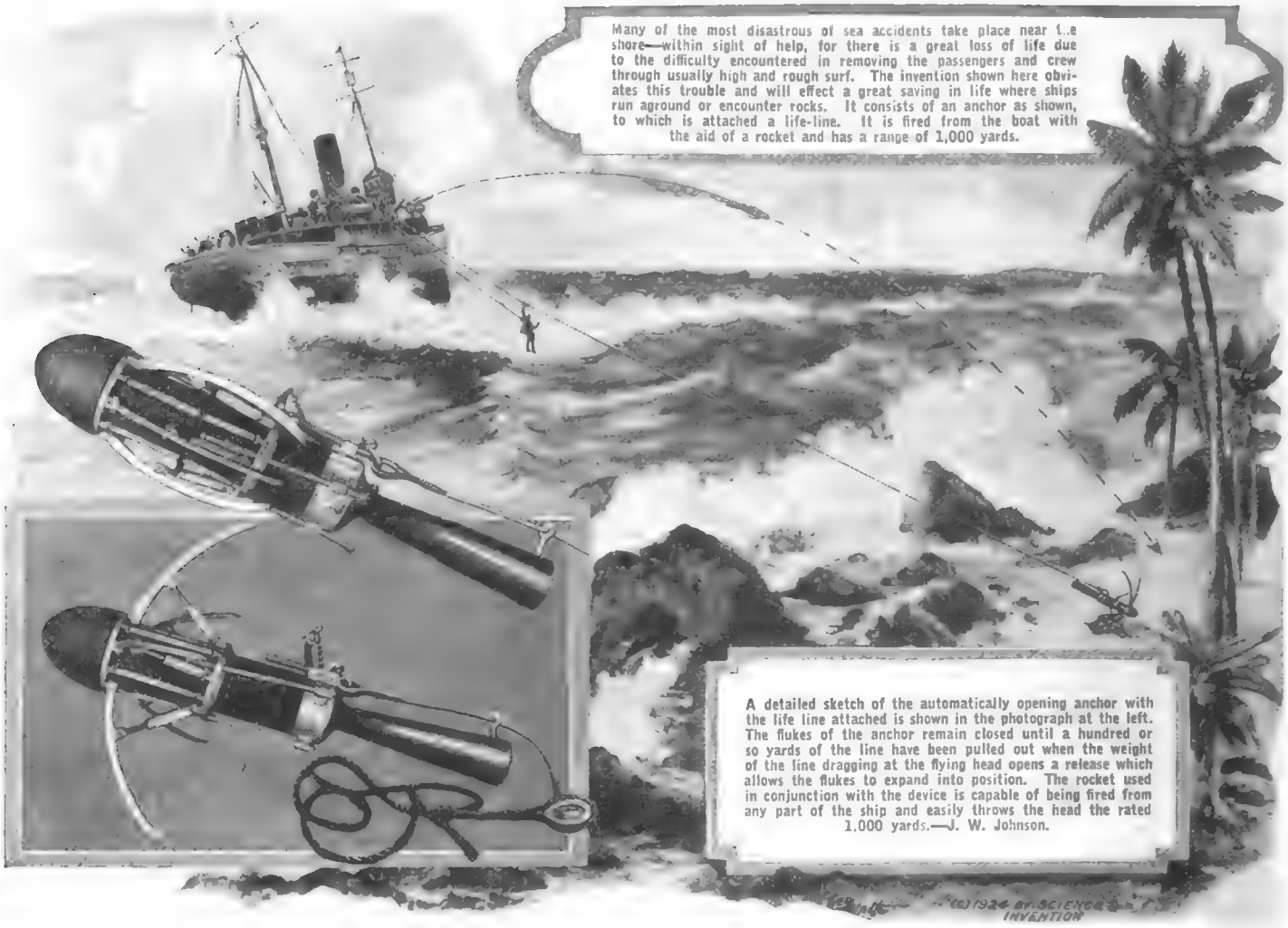
Rocket Life-Line Anchor

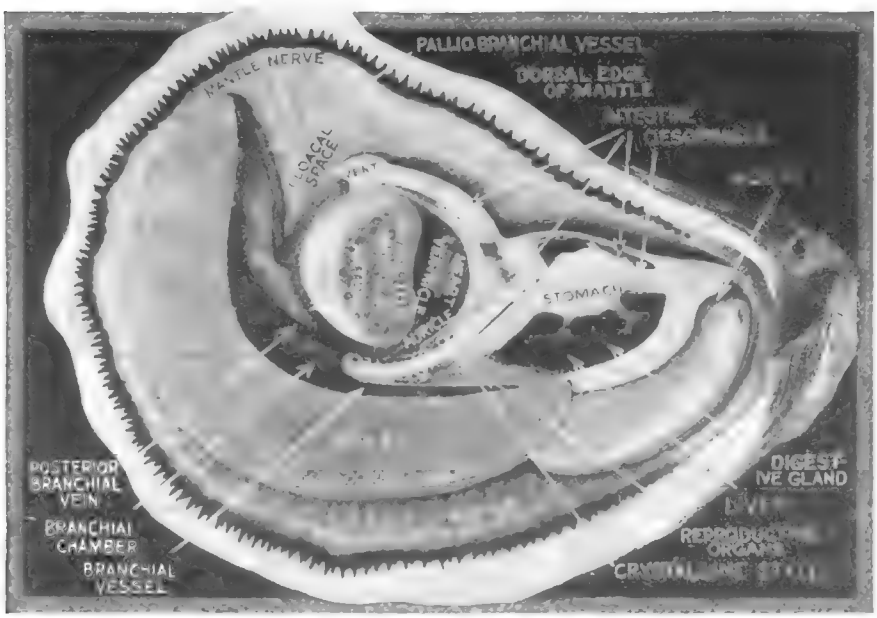
Many of the most disastrous of sea accidents take place near the shore—within sight of help, for there is a great loss of life due to the difficulty encountered in removing the passengers and crew through usually high and rough surf. The invention shown here obviates this trouble and will effect a great saving in life where ships run aground or encounter rocks. It consists of an anchor as shown, to which is attached a life-line. It is fired from the boat with the aid of a rocket and has a range of 1,000 yards.



A detailed sketch of the automatically opening anchor with the life line attached is shown in the photograph at the left. The flukes of the anchor remain closed until a hundred or so yards of the line have been pulled out when the weight of the line dragging at the flying head opens a release which allows the flukes to expand into position. The rocket used in conjunction with the device is capable of being fired from any part of the ship and easily throws the head the rated 1,000 yards.—J. W. Johnson.

(C) 1924 BY SCIENCE & INVENTION

The Oyster's Body



Many think an oyster is not a living animal, at least not like a fish. The sketch above will prove otherwise and leave no room for doubt. Note first the stomach. It is fed from a mouth just as in the case of the fish which live in the water with it. Then there is the respiratory system consisting of gills through which the blood from the heart flows and is purified. Means are also available for carrying away the body's waste.

Under Water

ONE of the most startling demonstrations given at a recent Physics Convention at Paris was the use of an oxy-acetylene torch with the flame and work submerged in water. The operator of the torch boldly thrust the tip of the flame beneath the surface of water and directed it against a steel plate which lay on the bottom of the tank. After a preliminary heating he brought the temperature of the metal to such a point that it would unite with the oxygen fed direct from the torch tip. After the preliminary experiment, a diver equipped with a torch descended several feet below the surface of a large tank and entertained the astounded scientists by cutting all sorts of fancy designs in half-inch steel plates while under the water. In engineering circles it is said that this discovery and adaptation of the acetylene torch is of the greatest importance in salvaging ships and releasing buried treasure which has long been locked in the steel hulls of ships. —Photo—Pure Iron Era.

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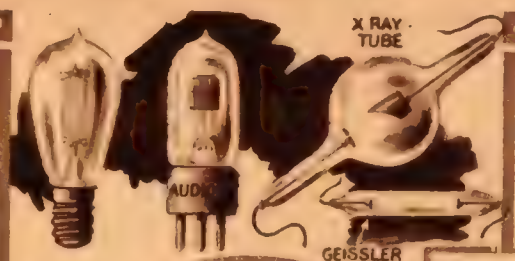
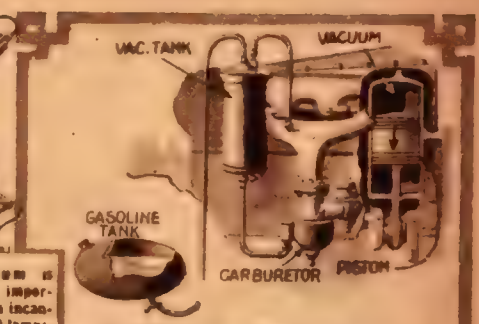
Vacuum Finds Many Uses

By H. WINFIELD SECOR, E. E.

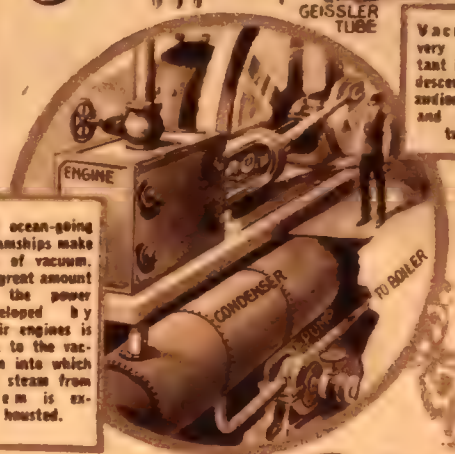
Everyone has seen the vacuum cleaner in use. It does its work entirely by air pressure.



Vacuum is very important in incandescent lamps, audions, X-ray and Geissler tubes.



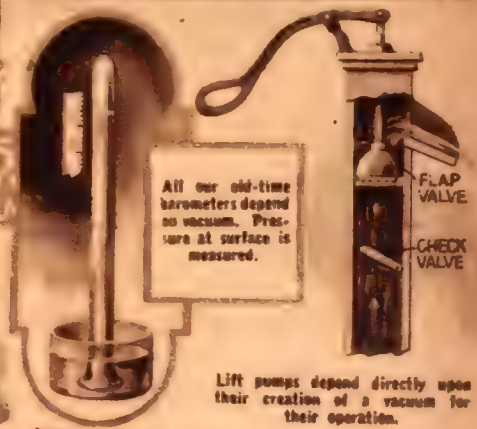
Automobilists often depend on vacuum to feed the gasoline from his tank to the carburetor. The air in the vacuum tank is partly exhausted by the intake of the engine, and the gasoline is in turn sucked from the storage tank to the vacuum tank.



All ocean-going steamships make use of vacuum. A great amount of the power developed by their engines is due to the vacuum into which the steam from them is exhausted.

Vacuum operates the self-filling fountain pen.

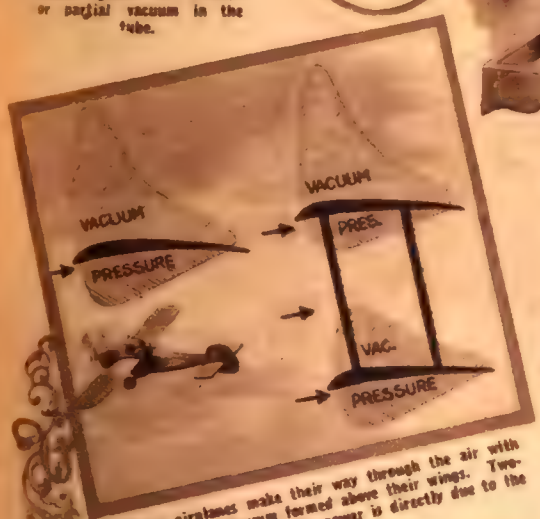
Siphons are all operated by the air pressure acting on the surface of the upper liquid against the suction or partial vacuum in the tube.



All our old-time barometers depend on vacuum. Pressure at surface is measured.

Lift pumps depend directly upon their creation of a vacuum for their operation.

The druggist obtains pressure by vacuum through an inspirator, using force of water as power.



All our airplanes make their way through the air with the aid of the vacuum formed above their wings. Two-thirds of the wing's lifting power is directly due to the vacuum action.

All our simple syringes use vacuum. The air is exhausted by means of a plunger or bulb, so that when it is released, atmospheric pressure drives the fluid into the cylinder.

The vacuum bottles with which we keep picnic drinks warm or cold are a success because the vacuum between the inner and outer walls is a practical heat insulator. The substance in the bottle cannot radiate or absorb heat.

The plumbers lose many hours of work due to the push-pull effect of the device shown above. It utilizes both vacuum and air pressure.

The classical Magdeburg hemispheres experiment shows the force vacuum may exert. Two hemispheres were placed together and the air between them exhausted. Sixteen teams of horses were hitched to each, and with all their strength could not separate them.

Our drinks through straws at the soda fountains are lifted by an air pressure due to a partial vacuum.

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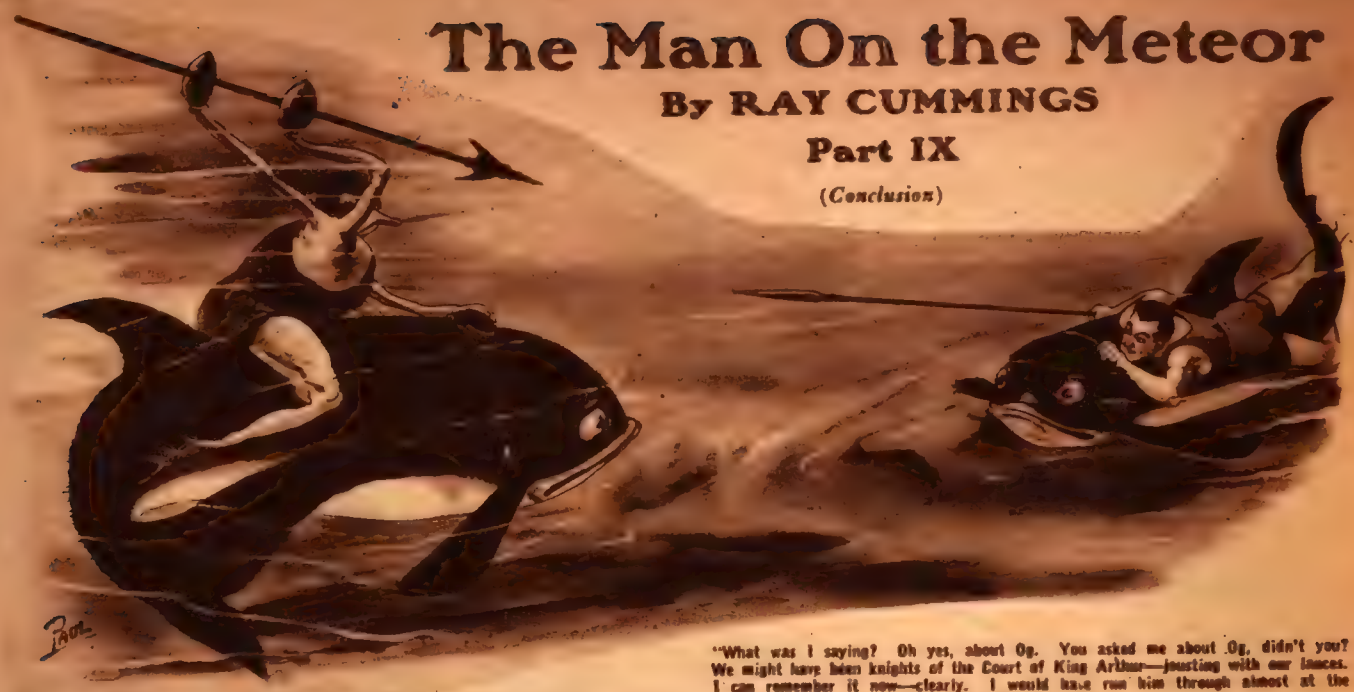
The Man On the Meteor

By RAY CUMMINGS

Part IX

(Conclusion)



"What was I saying? Oh yes, about Og. You asked me about Og, didn't you? We might have been knights of the Court of King Arthur—jousting with our lances. I can remember it now—clearly. I would have run him through almost at the first tilt, but . . ."

WITH no memory of past events, a young man suddenly comes to his senses on a meteor which is part of one of the rings of Saturn. He looks for nourishment and finds the mouth of a cave. As he looks toward the cave a girl comes into view. One day, upon returning to the cave, Nona, the girl, shows Nemo, as the man calls himself, several mollusks which make good food. To gather more of this food, they wade into a stream. Nemo sees Nona's head is completely engulfed. Soon his head goes under water and he feels the liquid rush into his lungs. However, by violent effort he is able to breathe the water.

Later they see coming toward them a party of ten people, four men and six women, who are somewhat human in form, but have four arms like the tentacles of a cuttlefish. Nemo and Nona are captured and tied by them.

They are taken by the Marinoids, as the members of the party call themselves, to the city called Rax. This city is built in the stream of underwater vegetation.

A man named Og insulted Nemo and challenged him to a fight. The fight took place in front of the palace of the ruler and Nemo was defeated because Og had a peculiar property, which was characteristic of the Marinoids, enabling him to send a charge of animal electricity into the body of Nemo, thereby rendering him unconscious.

For a year things go along peacefully, when suddenly the daughter of a Marinoid family disappears. This is repeated again and again until thirty of the young women of the city were stolen. Later Nemo saw a strange figure in the street. Suddenly all light is obliterated and Caan and Nemo, swimming through the darkness, find a woman unconscious, shocked into insensibility by animal electricity. Nemo comes to grips with the man attempting to abduct the woman and finds it to be his old enemy Og. Nemo returns to his home to find that Nona is gone.

The Water of Wild Things, an unknown stretch of sea, is the home of the tribe doing the kidnaping. An expedition is organized to bring the stolen girls back, and led by Atar, the king's son, they go into the Water of Wild Things. Atar, Nemo and Caan penetrate a barrier of vegetation, which guards the entrance, descend the side of a perpendicular cliff and soon see lights in some sort of a dwelling place. They enter the place and find it to be crowded with other people. Og is seen talking to them and on a raised platform is Nona.

Og declares his love for Nona to the people and says that he will lead them to victory over the Marinoids and that Nona will be their Queen. One of Og's lovers becomes jealous and protests. She is waved away and suddenly returns with a dagger to kill Nona. Nemo interferes and releases Nona. They start away from the Water of Wild Things.

Later in the day, through the aid of Og's jealous lover, Nemo with Nona and the remainder of the party, make their escape, after learning that Og, as leader of the tribe who call themselves the Maagogs, plan to make war on Rax and capture the city. The party on returning home tells the king of their discovery who begins preparations for war.

There is a season of merry-making after the war has been announced to the Marinoid citizens. During its course a half-breed hurls a needle fish in an attempt to kill the Marinoid King. A Marinoid girl thrusts herself in the fish's path, saving the King's life. The Prince and Nemo make a reconnoiter to a neighboring city and find that the he breeds within the kingdom have already begun a massacre. The war is on!

I LED my army out of Rax. The details of its organization I had left to Atar and Caan, while Nona and I were on our expedition to Gahna. They had done their work well; and within an hour after our return we were ready to leave—to face the advancing Maagog forces.

We left from the roof of Rax. The broad, open space there was ample for mobilization, and in the center of it my forces were gathered. *You* of a greater civilization, might call this army of mine meagre. Yet to us Marinoids it was huge—the largest group of fighting men these people had ever conceived of organizing.

Some two thousand men, girls and dolphins—the product of all the Marinoid cities and the rural population. We had many more who wanted, and were able, to join us. But these I left at home—some in Rax, some in the other, smaller cities. So that at home—in the event of disaster to our fighters in the open water—we would not be quite defenceless.

An army of two thousand! It was not very much, of course; but it was equipped and organized—with a plan of action which I shall tell you in a moment. That it would be ample for victory, I did not doubt. Og and his Maagogs might outnumber us—of that I could not say. But we had fighting qualities which the slow lumbering Maagogs could not possibly equal. We would be easily victorious, I thought; but Nona was not so sanguine.

In spite of my commands the people of Rax, many of them, had gathered on the city roof to see us leave; a circular fringe of them jammed the edge of the roof, waiting to cheer our departure.

But they did not cheer. With solemn faces they stared upward at our columns as we rose into the water—women staring after their husbands and sons, even their daughters—women and old men staring, and wondering which of their loved ones would return alive to them.

In command of the entire Marinoid forces, I rode alone on a dolphin—with hands free and with only a lance fastened flat against the dolphin's back and a dagger in my belt. I was first off the roof of Rax. As I rose, gliding smoothly upward and outward, I looked down to see the city dropping away.

Then I shouted my command, and we started vertically upward—our first attack upon the enemy.

THE ARMY STARTS

A column of young men, swimming five abreast, came up next—like birds rising in orderly array to follow their lone leader. It was an inspiring sight—this sinuous, curving line of swimmers. It swung into the water, bent like a huge rainbow over the city, straightened, and followed me diagonally upward.

Soon Rax had dwindled small and dim in the water below. But I could see Nona's forces—the girls mounted on dolphins—as they too were starting. Then Rax, now so far beneath me, blurred and was lost in the gray-green haze of water; and I turned my attention ahead.

The back-bone of my army was the line of young men swimming five abreast behind me. Five hundred of them there were—young, powerful swimmers—youths at the height of their physical strength. Each was by nature capable of shocking into insensibility with an electric discharge, any opponent he could touch by head and heels simultaneously.

These young men were unarmed; I felt that they could use their natural weapon to better advantage when swimming free-handed.

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Nona's corps consisted of some two hundred girls mounted on dolphins. Each with a long, lance-like spear in her hands. Nona commanded them—with ten extra girls, each to control a group of twenty.

Then there was Atar's corps of sleighs—the "light-sleighs" which I have already described. Atar himself had a dolphin mount. In each of the ten dolphin-drawn sleighs was a single occupant—an older man. These sleighs I would use to precede us—to throw light upon the enemy, blind him, and cover our onslaught made from behind.

The "sleighs of darkness"—ten of them, dolphin-drawn, and each with two occupants—were commanded by Caan, himself riding a separate dolphin. These sleighs were for darkening the water in the event of a catastrophe to our fighters—to cover our retreat wherever it might be necessary.

THE ELECTRIC POWER

For the rest, my main forces were a thousand fighting men—older men in whom the electric power was waning. They were armed with various types of spears—daggers, javelines and lances. They were leaving Rax in a long swimming line some ten abreast.

Such was my army which now was following me into battle. I led it upward. Behind me I could see the long columns of swimming figures—the sleighs in two broad groups—the girls on the dolphins in squads of twenty, each with its leader apart.

Ahead of me lay open water—a gray-green in the half-light, dim and blurred. Far overhead I knew was the rocky ceiling which marked the top of this watery, subterranean world; and the ooze and sand of the sea-bottom was perhaps two thousand feet beneath me.

I was heading for Gahna. The water here was almost free of vegetation, but not wholly so. Occasionally thin, waving spires of seaweed, covered with air-pods to sustain them, reared their heads. I threaded my way among them; and with every turn I made, the line of swimming figures behind me followed.

Soon I conjectured I must be half-way to the former site of Gahna. The Maagogs would probably follow the sea-bottom in their advance, for they were all indifferent swimmers, flabby of muscle and short of breath. It was time for me to descend and locate them.

I waited—as it had been pre-arranged that I should wait at this point; and as I hung poised in a broad stretch of empty water,

Our light-sleighs were of little use here; hastily we sent them speeding upward, to bring down our main army to our assistance. Atar and I on our dolphins circled about. The black fishes were everywhere; confusion again; the lashing figures of our young men as they met the black, ugly little things—all jaws, and teeth like needles.

my army swung up and gathered. In two huge concentric circles, the men swam slowly around me, while the girls on the dolphins moved lazily back and forth above and below.

A beautiful sight, these girls—slim bodies clinging closely to the sleek backs of their graceful mounts. And Caan and Atar with their squads of sleighs holding motionless on the outskirts.

In the center of it all, Nona rode her dolphin to join me.

"We are all ready, Nemo." And she laughed gaily; though searching her face, I could see no laughter in her solemn eyes.

I told her then to wait while I went down to the sea-bottom to locate the enemy. She nodded; and I left her.

Slowly I drove my dolphin around the circle of my men—shouting a word of encouragement here and there. I consulted a moment with Caan and Atar; waved at Nona as I passed her again, and dove my mount downward.

The ring of waiting figures above me faded into dimness and were lost. I was alone in the water.

It took but a few moments to reach the bottom; it came up to me, by optical illusion tilted vertically on end. A hundred feet above it I righted my mount.

I was over a level floor of sand, with cactus-like growths here and there. Empty; there was no sign of Maagogs.

Ahead of me, in the direction of where Gahna had once stood, I saw the shadows of a forest. I advanced toward it; and from it were emerging the first lines of the oncoming enemy.

THE COMBAT

But my heart sank. There were very many of them.

At once I raced my dolphin upward. And my thoughts were racing also. Again I had lost another opportunity for ambush. Had we reached the forest before the Maagogs began to emerge, we might have surprised them there. The forest was several miles long and a mile broad perhaps, in the horizontal direction from Gahna to Rax. A mile of thick vegetation—tree, spires and a tangle of vines and weeds rearing themselves several thousand feet up into the water. The Maagog army was now traversing that mile-width of forest. Perhaps, if I could cut them off in there—attack them piecemeal as they emerged. . . .

I was again with my own forces. Nona, Atar and Caan rode their mounts hastily to meet me, and I told them the situation.

It took us but a moment to decide. We would maintain this upper open water as our base. I ordered Atar with his light-sleighs and half of our electric fighting men, to follow me down. I would attack these first columns of the enemy as they came out of the forest.

Nona, with her girls, was to ride swiftly above the forest, descend on its other side and drive the last of the Maagogs in. We did not want any of them to retreat toward Gahna.

I waited, while Nona with the dolphins dashed upward and away. The girls had all been flushed and eager; but as they swept by me in a line I saw that each little face was white, set and grave.

(*Continued on page* 511)

Nona's corps consisted of some two hundred girls mounted on dolphins. Each with a long, lance-like spear in her hands. Nona commanded them—with ten extra girls, each to control a group of twenty.

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And what need of steamers anyway. Load up your ship with a full cargo; screen off enough gravitation so the ship will rise a mile above the ocean and pull it to its destination by means of one or more airplanes harnessed to it.

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

No. 32. The Secret of the Gravitation Screen

(Author's Note Man is able to reflect Sound, Heat and Light. All analogy leads us to believe that gravitation is a form of energy closely allied to sound, heat, light and electricity. Hence it should be possible to find some means of screening it off, so as to preserve bodies from the attraction of gravitation. Such a screen or reflector could be made use of in many ways.)

CHAPTER I

"SILAS," said Doctor Hackensaw, "I've got something to show you today, that, in certain respects, beats anything I have yet accomplished. In fact it opens up entirely new fields for investigation, and there is no telling to what it may lead us. Silas, I have found the means of reflecting gravitation!"

Silas Rockett's face fell. "Oh, is that all!" he exclaimed in a tone of contempt.

"Ah Silas," returned the doctor, "I see you don't realize the transcendental value of the discovery, but its practical bearings are simply immense. To take but a single example, all our methods of transportation will be revolutionized since we can deprive objects of their weight at will, and blow them around to their destination by suitable air-currents. Just think, every man can carry around his own airplane in the form of an umbrella made of "radalumium"; that, by the way, is the name of my new metal. When the umbrella is opened, you will rise in the air, and a propeller worked by bicycle pedals will carry you wherever you wish to go. Why, man, the air will be crowded with these aerial bicycles and the traffic policemen will have their hands full attending to them!

"You mustn't believe that my investigation was an easy one. I attacked the problem from many different points before I finally met with success. You are perhaps aware that the scientist Majorana, from the result of certain pendulum experiments, concluded that a mass of lead, surrounded by mercury, exerted less gravitational force than when not so surrounded. This seemed a clue, but after hundreds of experiments with lead and mercury I was no nearer my goal than before. Next I tried 'interference.' As you probably know, two sounds, by interference, may be made to destroy each other and produce silence. Two lights may likewise extinguish each other and produce darkness. It seemed logical to believe that two attractions could likewise be made to interfere and neutralize each other. Unfortunately I had no attractive force at hand with which to neutralize that of the earth. Then I thought of magnetism. Magnetism and gravitation must be fundamentally alike. If I could find means of reflecting magnetism, the same substance would probably screen off gravitation.

THE annihilation of gravity always gives food for thought. Suppose you had this marvelous gift placed in your hands—what would you do with it? Some of the possible and impossible things which you could do with a Gravity Eliminator, such as related by Mr. Fezandié, are described interestingly in the accompanying story, wherein the principal actors are Dr. Hackensaw and his friend Silas Rockett, the village cut-up, who has become a reporter for an important metropolitan daily. Don't fail to read about Mr. Rockett's startling experiences.

METAL LIGHTER THAN AIR

"Now, as you know, I have discovered hundreds of new chemical combinations, alloys, allotropic forms of matter and even new elements. Among these there was a new metal, lighter than air, and which I had called 'radalumium' because radium and aluminum entered into its composition. I had made only about one gram of this metal, but had been astonished at its lightness, for it floated above the air in the retort, and when released, flew up to the ceiling of the laboratory. So I turned my attention to manufacturing this radalumium on a large scale. Luckily my first experiments were cautiously made, else I shouldn't be here to tell the tale, for a ball of the new metal, as it rose, broke the glass retort and shooting like a bullet, passed through the ceiling and up into the sky. That made me more cautious. I saw I must produce this metal in small particles and afterwards fuse these particles together with proper precautions.

"I won't bore you with the details of my experiments. Suffice it to say, I discovered that I must cast my gravitation screens in thin sheets in the form of wheels with plenty of vacant space between the metal-spokes, as in the diagram shown.

"By placing a heavy weight on these sheets they could be kept from flying up into the sky.

"By using several of these sheets one on top of the other and revolving them so as to shut off more or less of the earth's gravitation, I could regulate at will the weight of the substance above the screen. When all gravitation was screened off, the whole apparatus would rise up into the air; if properly ballasted below, so as to remain horizontal in the ascent.

"That stuff would make a dandy car for traveling off to the planets," suggested Silas. "Shut off the earth's attraction and let in that of the sun or any other heavenly body you wished to visit, and away you'd go!"

Then, too, think of the advantage of my gravitation screens to architects and others. You can carry a house from one city to another through the air. The house-trust can manufacture houses by the thousand in one spot, using efficiency methods and quantity production.

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"Indeed," said Doctor Hackensaw, smiling. "You seem to forget that attraction varies inversely as the square of the distance. To us here, the moon's attractions is greater than that of any other heavenly body, but even that would be almost imperceptible. Gravity on the surface of the moon is 2.65; that is to say a body falling near the surface of the moon would have its velocity increased 2.65 feet each second. As the moon is only some two thousand miles in diameter, such a body would be only one thousand miles away from the center of attraction while the earth is 240,000 miles away. In other words, the greatest pull we could obtain for the car from any heavenly body would be $\frac{S^2}{R^2} = \frac{2.65}{X}$ in which S is the

However, he soon got beyond the limits where the air had any appreciable effect on the car's flight. Then the last vestige of his weight left him and he found he could swim about in the air or somersault around in the car in a way that would have made a circus acrobat green with envy.

distance of the moon from the earth, R the radius of the moon, and X the required attraction of the moon on the car. Work it out and you will find that the pull of the moon on the car would be such a small fraction of an inch the first second that the slightest resistance would prevent the car from ever starting at all. And if it did start, it would take hours to go the first few miles."

"But you could give the car a push to start it," suggested Silas.

"True, but that would not be necessary, as you will see for yourself when you try on my *anti-gravitation shoes.*"

CHAPTER 2

THE ANTI-GRAVITATION SHOES

Doctor Hackensaw led Silas into the center of a large open field. There stood a table firmly tied down to the solid rock beneath by heavy chains.

Clamped to the top of the table were a pair of clumsy-looking shoes resting on their sides.

"There, Silas," said Doctor Hackensaw, "those are my anti-gravitation shoes. Just lie down on the table and I'll fasten them to your feet."

"Why can't I stand up to put them on?" asked Silas.

"Because the time for you to fly up to heaven as an angel hasn't arrived yet! Be a good boy and do as you're told."

With a groan, the reporter lay down on the table and Doctor Hackensaw fastened around Silas's body a metal frame-work held by a strong chain wound on a windlass. Then the doctor securely buckled the shoes on Silas's feet, and after placing himself in a cage anchored to the ground, he called out:

"Are you all ready?"

"Ye-es," replied the reporter, somewhat dubiously.

With a chuckle, Doctor Hackensaw pressed a lever, and the table tilted so as to bring Silas standing on his feet. At the same moment the clamps that held the shoes to the table were released. Then came a terrific blast of wind and Silas found himself jerked off his feet and carried high up into the air, suspended head downwards in his flight. The chain of the windlass unwound until about thirty feet were out, and then stopped.

"Hi! Pull me down, quick!" cried Silas. "I can't stand this! All the blood's rushing into my head!"

"All right," replied the Doctor, and a pull on a second lever started the windlass at winding up the chain, pulling Silas to the ground and clamping the shoes down to the table again.

"Whew!" cried Silas, as he wiped the beads of perspiration from his brow, and smoothed his ruffled clothing, and still more ruffled temper, as he thought of the ridiculous position in which he had been placed.

"Why didn't you warn me of what was coming? It's a blame-fool invention anyway, and there's no money in it. All you could do with it would be to use it in some Coney Island amusement resort. That's about the only place where you could find people willing to pay out good money for an experience like mine."

"Don't take it to heart, Silas," said Doctor Hackensaw, soothingly. "It was even worse

With a chuckle, Doctor Hackensaw pressed a lever. . . . At the same moment the clamps that held the shoes to the table were released. Then came a terrific blast of wind and Silas found himself jerked off his feet and carried high up into the air, suspended head downwards in his flight. "Hi! Pull me down, quick!" cried Silas. "I can't stand this! All the blood's rushing into my head!"

for me the first time I tried it. Luckily, I had taken all my precautions."

"But what in the world started me off so?" demanded Silas. "You said the moon wouldn't pull me up."

"It wasn't the moon," explained the doctor, "it was the wind."

"The wind? What do you mean?"

GRAVITY RUNS RAILROAD

"Why our atmosphere weighs fifteen pounds to the square inch. In the sole of each of these shoes is a very thin sheet of radalumium. So long as this metal was vertical, it created almost no disturbance in the atmosphere. But as soon as the soles of the shoes were horizontal, they cut off the earth's attraction from the entire column of air above them. The pressure of the surrounding air forced this column up, and the new air losing weight in its turn, a strong wind arose which would have carried you up into the sky if you had not been securely held down by the chain. Silas, this invention of mine is going to revolutionize transportation. I'll show you how simply people and cars can climb over mountains at practically no expense."

So saying, the doctor drew his note-book from his pocket and made a rough sketch.

"There," said he, "is a track going up one side of a mountain side and down on the other side. P is a passenger or a car held to the track by the rod C. A double wheel W at the lower end of the chain is free to roll along the track, the whole being grooved so as to run on the rail.

"The passenger has on his shoulders a knapsack containing the anti-gravitation metal. A knob outside of the knapsack enables him to shut off as much of the earth's attraction as he desires. When he turns the knob he becomes lighter and up he soars following the track to the top of the mountain. There he reverses the knob, letting in more of the attraction, and as he becomes heavier he slides down the other side. Not a cent to pay for fuel or power of any kind. Gravitation does all the work. Merchandise can be transported for practically nothing, for of course a car can be carried as easily as a passenger. No more shall we be obliged to make our roads level—a road with ups and downs will be far

(Continued on page 500)

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Wonderful Old Roman

By CHARLES

At the left above is a comparison of the bath with the Statue of Liberty. Below is the famous Pine Cone, which stands in a half dome building overlooking the beautiful Vatican Gardens. From each of the petals a stream of water issued. It originally stood on an island centerpiece in the midst of an artificial lake of the Campius Martius. Around it was a whole bed of artificial flowers and plants wrought in bronze. The Pine Cone is still in perfect condition, though it is no longer the centerpiece of a fountain. Some of the flowers have also been retained.

A ROMAN BATH

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PINE CONE

Not only do the Roman baths represent one of the highest points in their building but the buildings themselves developed a style of architecture and a grandeur which is rivaled in very few places today. One of the large railroad terminals in New York City follows directly its style of architecture. Above we see the interior of Carcella's bath. It was forty-nine feet higher than the Statue of Liberty, and one hundred and fifty feet higher than Cleopatra's needle. This was one of the most sumptuous buildings ever constructed by man. Marble from Egypt, of various colors, was used for the entire interior facing of the building, while the arches and ceilings were covered with mosaic pictures; statuary of glass, ivory, bronze and gold was scattered promiscuously throughout. Through the central arch we see the beginning of the cold bath, and to the right through the sectional arch one of the warm baths for women. There was also a library, lecture room, theatre and gymnasium.

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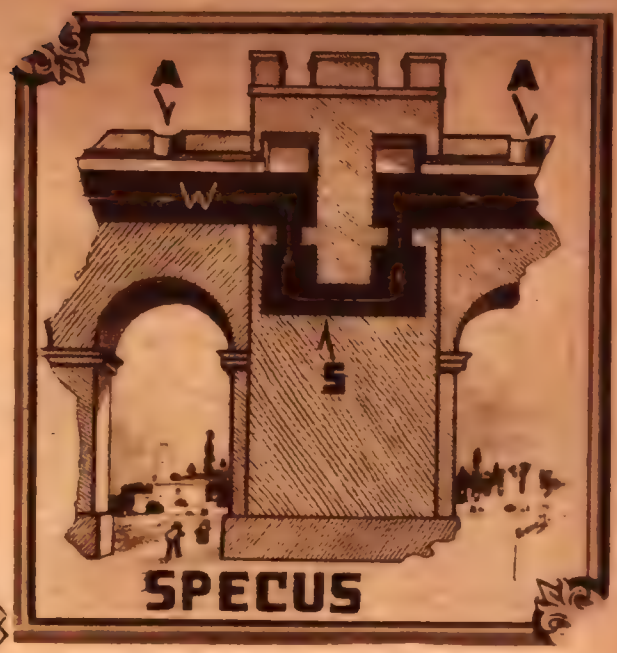
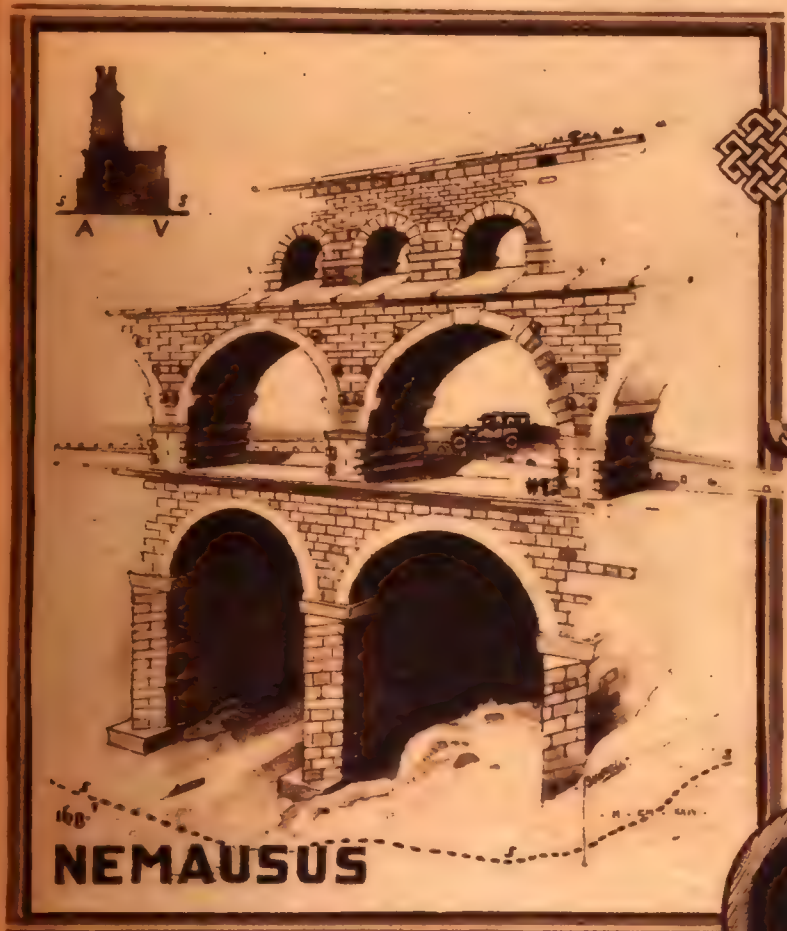
Baths and Water Systems

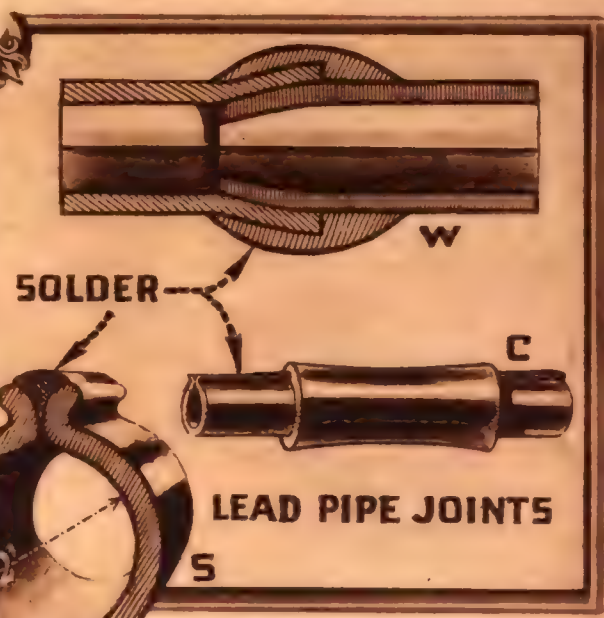
BEECHER BUNNELL

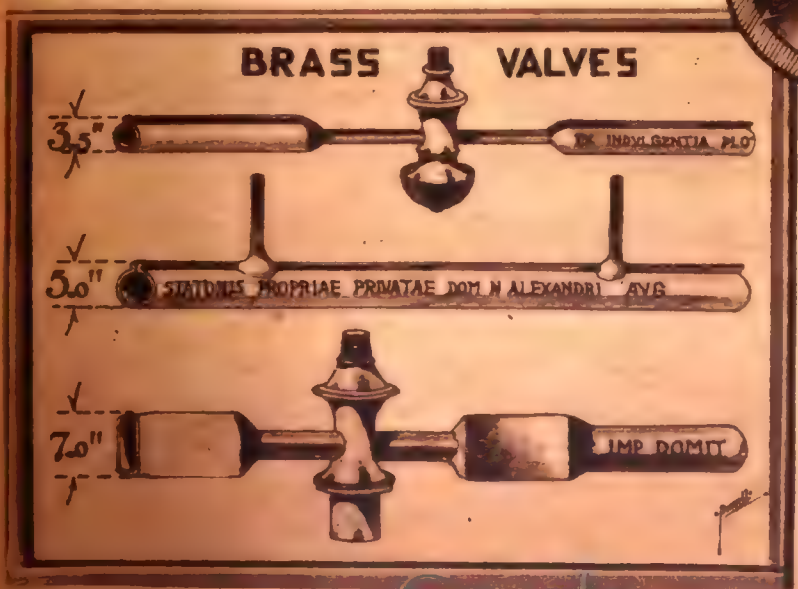
Since there were more than six hundred Roman baths, such as those described on the opposite page, millions of gallons of water were necessary to keep them in operation. Much of this water was carried over the city in aqueducts, one of which is shown below. The section shown in the illustration below stands near Nemausus still in almost perfect repair. It is one hundred and sixty-eight feet high. There was also a passage on the lower level for men and vehicles. The whole arcade was built of stone and brick and supported entirely by the arch work. This is only one of a dozen or so aqueducts which helped carry Rome's great supply of water. A gravity system transported the water in practically all cases. The valve system for protection used in these aqueducts, is shown in the sketch to the right. There was a strip thirty feet wide on either side of the aqueduct, where no trespassers were allowed.



Above is a longitudinal section of a typical aqueduct entering the city of Rome itself. This valve arrangement was duplicated about every half mile in the line. It consisted of a tower where the water was forced to flow through two narrow openings, as shown. At A are two vents which were duplicated at every such tower, which released air compression pressure within the piping. These walls and apertures were used primarily to check the momentum of the water, since the fall was about six inches in a hundred feet. The arrows indicate the flow of the stream through these traps.







At the left are shown several sections of Roman pipe with brass valves. These valves are identical in design with those which we use today, the only difference between the two being the outside form. Most of the pipe used for interior purposes was made of lead in the form shown in the inset immediately above. Long sheets of the metal were laid out, then placed around a wooden stick, and the ends soldered. At W is given a cross-section of a joint made between two metal pipes, showing how the hot solder was "wiped" around the outside. On cast metal pipe many names and inscriptions were placed. Usually the name of the house owner was found upon the pipe, since water privileges were granted only for a lifetime. Each consecutive heir had to obtain permission for himself to use the water and pipes upon the decease of the previous master. Joints and seams were made in different ways: Poured in strictures, made with a soldering iron as at C, or "wiped" as at W. The latter method is still used.

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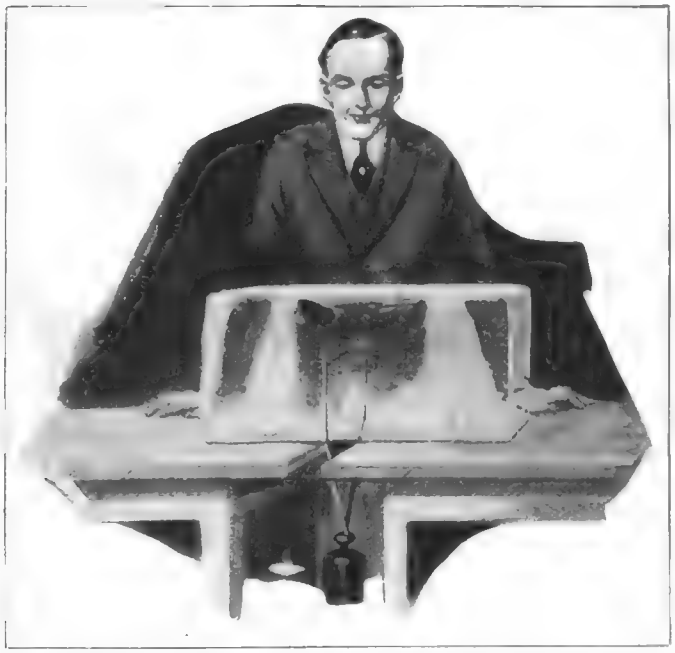
Ice Experiment



Place a weighted wire on a cake of ice as shown above and then bet your friends that it will not cut the cake in two. The trick is simple. The wire cuts but with the relief of the pressure the water freezes again above the wire. —Dr. Albert Neuberger.

Smokers' Paradise

The U. S. Department of Interior has just completed the experiment shown above, viz., placing smokers in a cosed room and letting them smoke away for eight hours. It was to determine the injuriousness of carbon monoxide from burning tobacco. It was found not to be dangerous in the least.

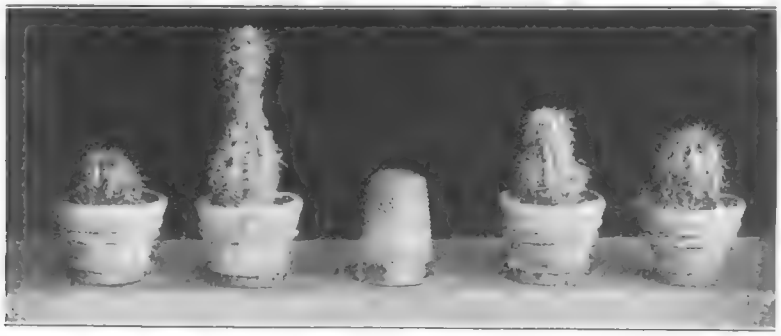
Handy Locator for Map

At the left is seen a new idea applied to locating points on a map. The name of the locality and the two key numbers are printed on the reverse side. When finding the spot on the map it is only necessary to ascertain the two key numbers, turn the map up as shown so that the edge of the map intersects the number on the edge of the face of the map corresponding to the one given and then run across the top of the reverse side where another set of numbers are located until the second of the key numbers is located and—there you are.
—Mr. Pleasant.

Aquarium

Below is shown a double aquarium, or rather a method of connecting two aquariums so that the fish in them may move freely from one of the bowls to the other. A large glass tube in the form shown is filled with water and is quickly inserted into the two bowls. The equality of the atmospheric pressure on the two bowls will not allow the water to flow out of the tube. In selecting a tube, be sure that the one used is large enough to permit the fish to pass through it. After filling it with water, place the palms of the hands or sheets of glass over both ends so that the tube is full of water when the ends are placed in the bowls.
—J. W. Paetznick.

Small Cacti Craze



One of the latest English fads is the collection of miniature cacti. The prevailing pots in which these plants are set are thimbles. Some samples of the plants are seen in the above illustration.
—S. Leonard Bastin.

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Electricity--Destroyer of Airships

By C. A. OLDROYD, AERONAUTICAL ENGINEER

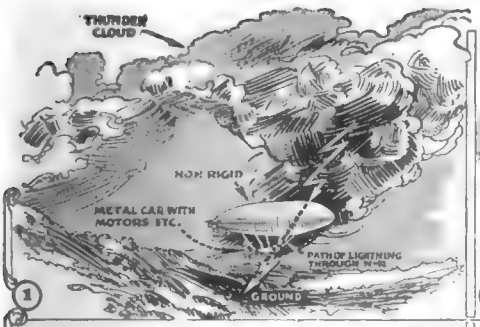
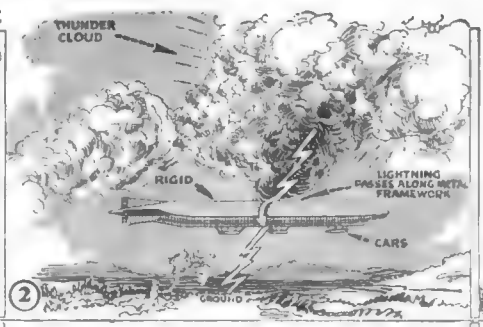


Fig. 1 shows lightning striking a non-rigid airship. It is likely to be ignited as all metal parts are massed together in the car below the gas bag, as lightning follows the easiest path, it naturally strikes the car.



With a rigid airship, Fig. 2 (Shenandoah type), whose framework is entirely metallic, there is a chance that although it may be struck by lightning, the ship may escape destruction by fire.

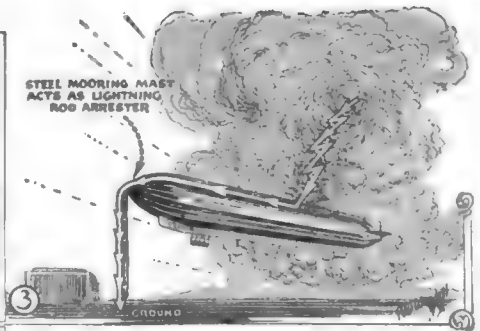
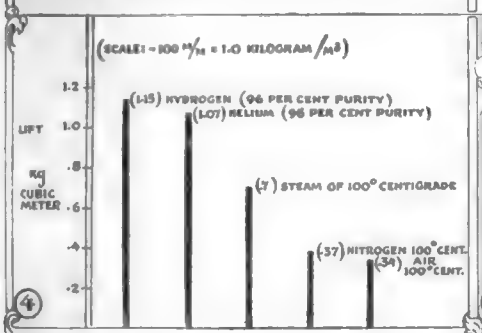


Fig. 3 above shows lightning striking a rigid type airship, the chances being that the discharge will pass along the metal frame-work of the airship and thence proceed to earth through the metal tower or mooring mast. The Shenandoah uses such a mast.



The airship designer is always looking for an extra light and inert gas. Aside from helium there are several gases that might be employed. The black lines above show clearly the relative lifting powers of various well known gases, including steam and hot air.

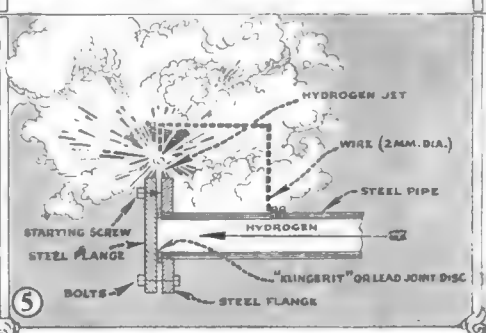


Fig. 5 above shows device used by Professor Nusselt, in demonstrating that static electricity ignited hydrogen gas leaking through a joint. If the pointed wire shown was not used and a little hydrogen allowed to leak out, the electricity present due to friction of the gas in the pipe caused the latter to ignite.

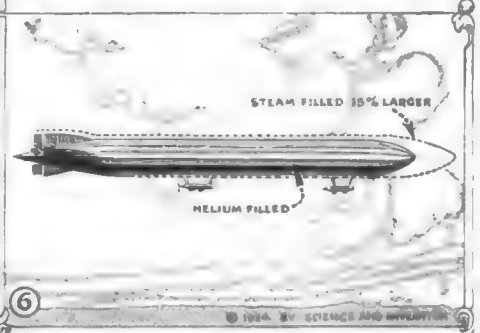
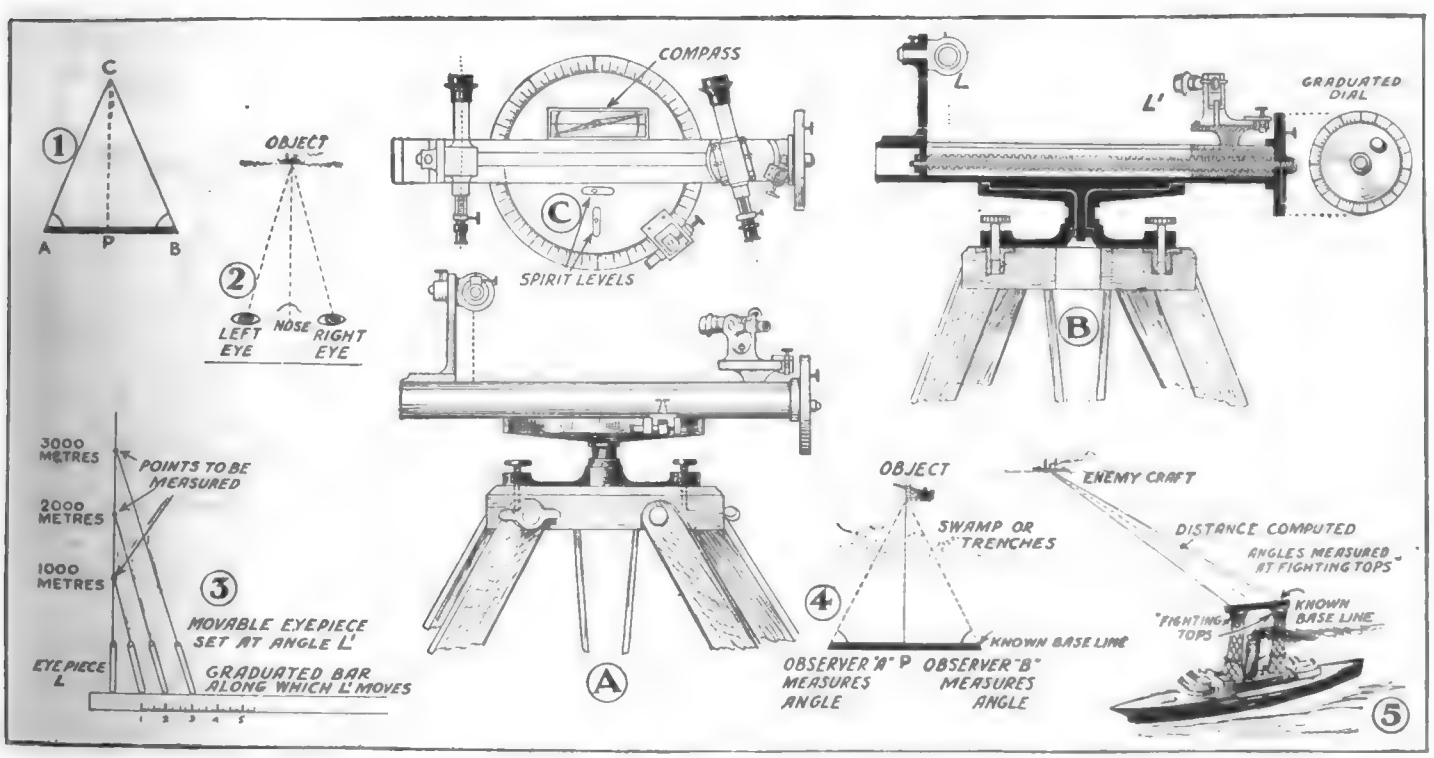


Fig. 6 shows clearly how much larger a dirigible would have to be in order to have the same lifting power when filled with steam as compared to helium. In other words, to lift the same load as a helium filled ship, a steam filled ship must be 15% longer.

The Telemeter--A New Range Finder



The well known method by which our two eyes measure the range of a distant object is shown in Fig. 1, the eyes automatically measuring the distance CP by solving the right angle triangles A and B. Fig. 2 shows the same idea in picture form. Figs. 3, A, B, and C show how the new French range finder known as the "Telemeter" very accurately measures the range whether it be one yard or sixty miles. It is said to have an accuracy of within one meter at a range of sixty miles. It is the invention of M. Faget of Paris and the device is composed of two eye-pieces or telescopes mounted on a graduated metal bar which is fixed to a rotating circular plate. The principle of the device is shown best in Fig. 3. The one eye-piece L is sighted directly on the object, while the second eye-piece L' at the right is moved until it is also trained on the object. The range can then be read off directly along a graduated scale. Diagram 4 shows how two observers, A and B, situated at ends of a known length base-line find the distance of target by measuring the angles at A and B. Fig. 5 shows ship range finder.—Ernest Brennecke.

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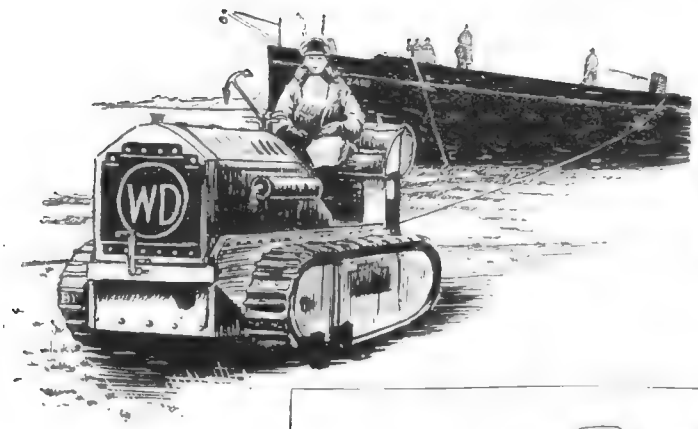
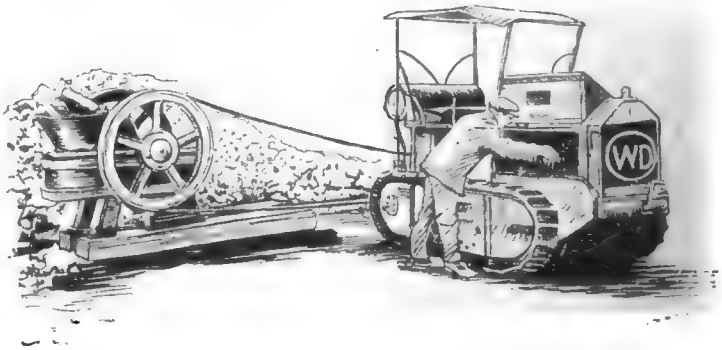
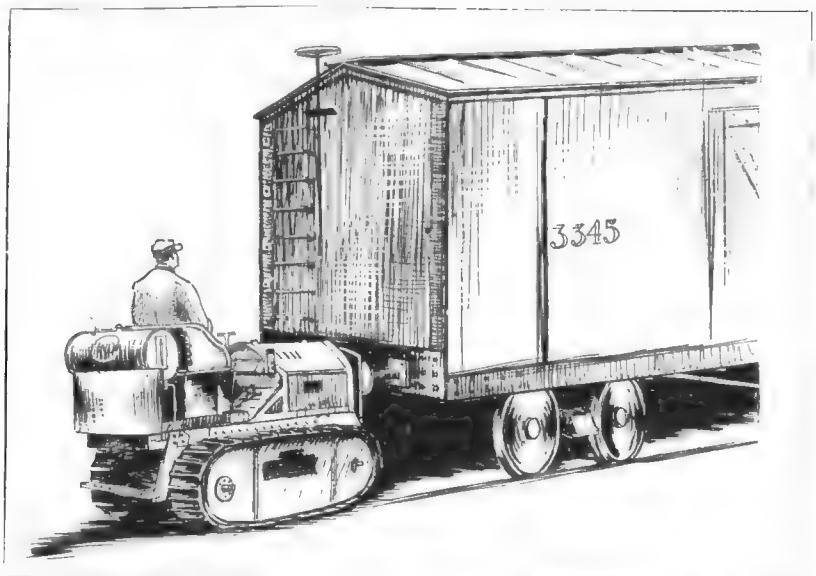
Odd Uses for Tractors

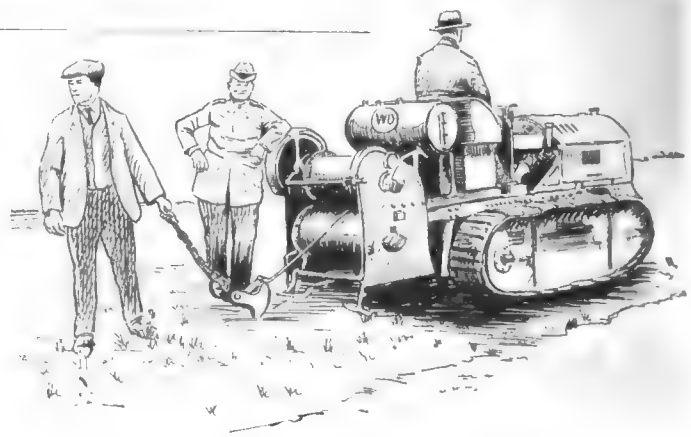




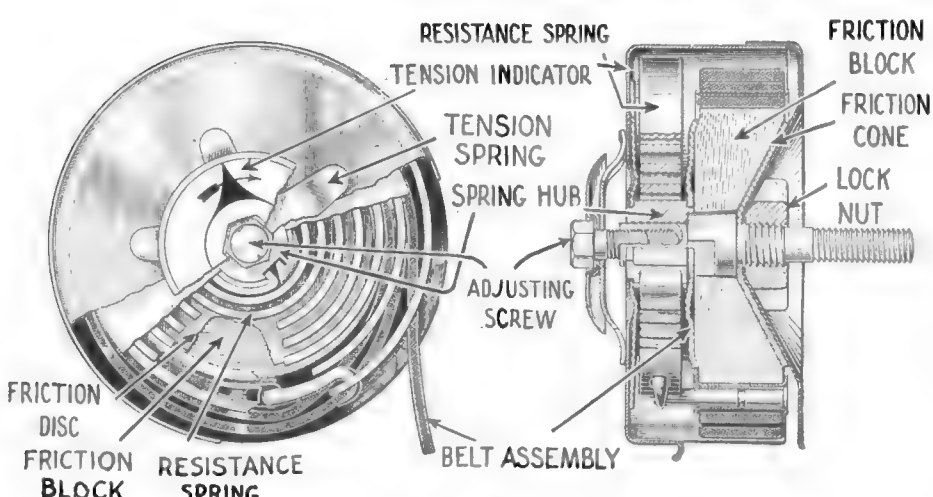
In Holland and in Germany many caterpillar tractors are being put to many odd uses as the accompanying illustrations indicate. The picture directly above shows a tractor being used to haul a canal boat. They are also being used to warp vessels into their piers. The picture below shows a string of wagons, carrying wood, being hauled by one of these versatile tractors. The odd sight of a tractor hauling a long line of wagons is uncommon in this country, but one frequently sees this in travelogue movies of foreign scenes. The tractor can haul a greater load than several horses and is so flexible that it can crawl over the roughest kind of ground, the worst hardship being on the engineer driving the tractor who gets pretty well shaken up now and then.

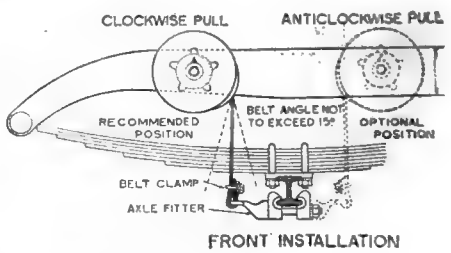


The picture above shows another use for the tractor—crushing bricks. The engine of the tractor is sometimes used for running wood-saws also. The picture at the immediate left shows one use of tractors which is being applied in many foreign countries, that of shunting freight cars on and off of sidings. A special form of tractor for this particular purpose was shown in a recent number of SCIENCE AND INVENTION. Below is shown a stump puller attachment fitted to a farm tractor. One can well imagine what a time-saving combination this makes when compared to the old-fashioned method of pulling stumps by means of a horse-driven windlass. With this machine on the scene the stumps can be pulled and then carted away on trailer trucks. Europeans are showing us many novel tricks with tractors, and while there are, without a doubt, more tractors in use in this country, thanks to Mr. Ford, we can learn many valuable methods by keeping our eyes on the foreign journals which cover this sort of work. Among the interesting new developments in Europe is an engine fuel to take the place of gasoline.



New Auto Shock Absorber





FRONT INSTALLATION

The drawings above and at the left show one of the latest auto shock absorbers. It utilizes a combination of friction and coil spring action. The main parts of this shock absorber are a conical-shaped friction drum of the oil-less bearing type, a large coil spring of the clock type, and a belt for connecting the mechanism of the shock absorber to the car axle. The picture above shows how the shock absorber may be attached to the axle and car frame in two ways. There are no metal bearings in this device, the makers claim. The coiled spring keeps the belt taut at all times, while the tension as well as the degree of friction is adjustable. This shock absorber is furnished in small, medium and heavy car sizes.

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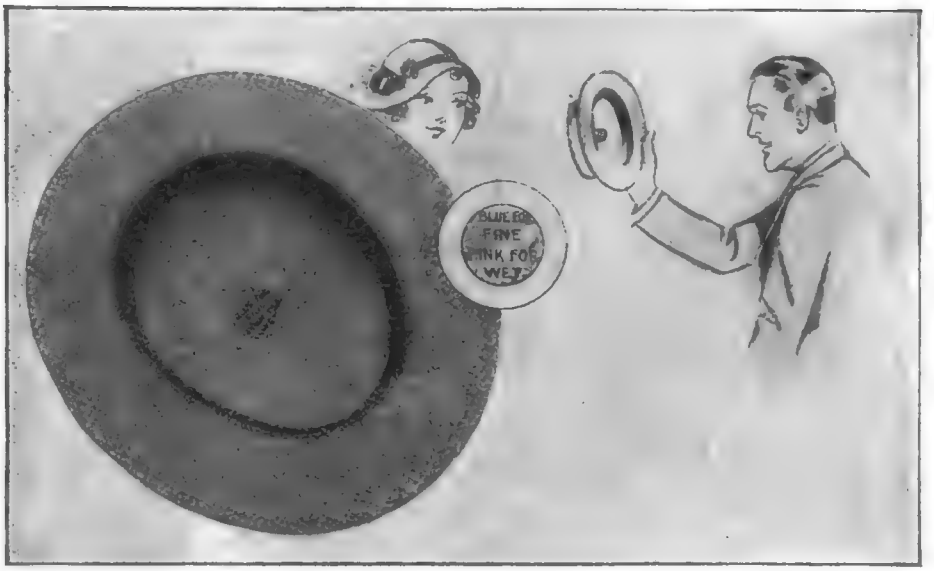
Fly Screen

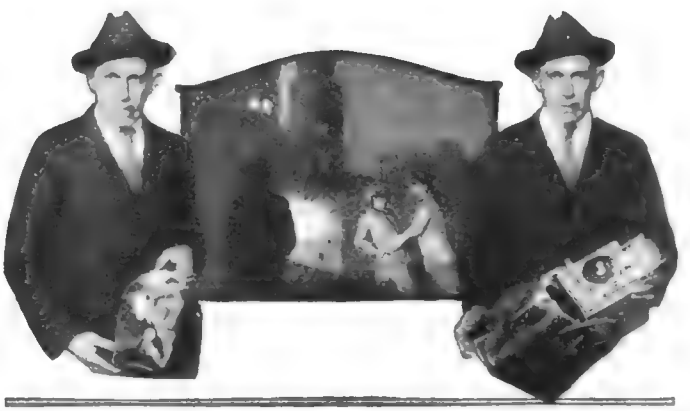
This fly screen has no slides, yet is adjustable to all windows. It is so constructed that one has merely to fit it in the opening of a window and press the sash down upon it, whereupon it extends laterally until it engages the side walls of the window frame. The edges are telescoping and diagonal braces cross the center. Although the wire is woven the individual strands are not soldered. These strands are free to change their angles with reference to those crossing them. —J. W. Von Stein.

Fair Weather Indicator



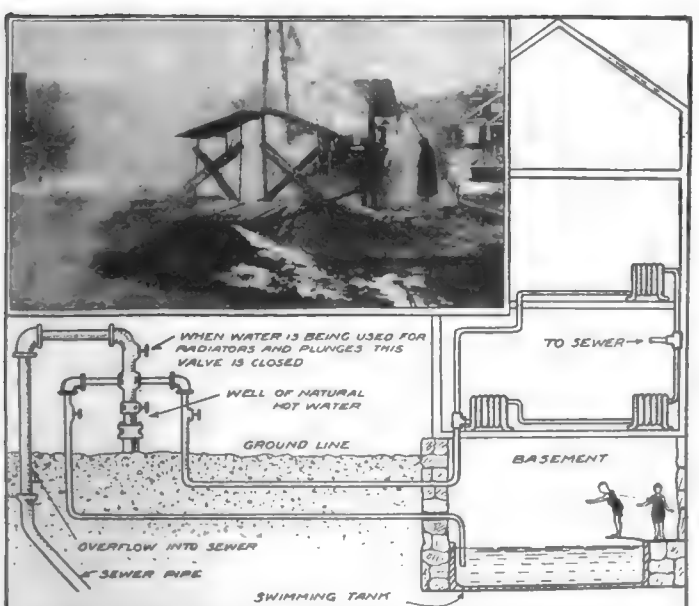
In the crown of the hat shown above a small circle of absorbent paper is fixed with adhesive. This paper has been previously soaked in a solution of one part of cobalt chloride, ten parts of gelatin and 100 parts of water. If the paper turns pink it indicates moisture in the atmosphere or in the hat.
—S. Leonard Bastin.

Detective Camera



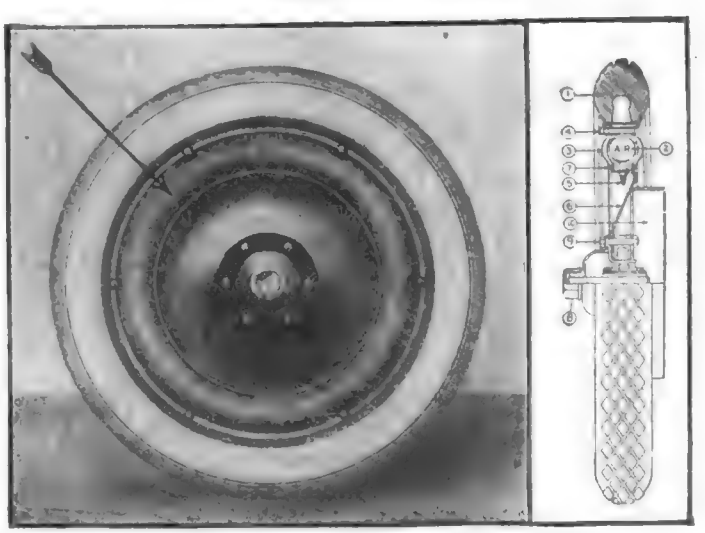
Newspaper photographers often have difficulty in securing photographs because the subjects refuse to pose for the picture. Monroe Stroecker, a staff photographer of the Detroit News, has overcome the difficulty by placing his camera in an over-night bag. A hole is cut out for the lens, and at the same time that the shutter is released, the flashlight powder is automatically ignited. —Chet Shafer.

Nature Heats Houses



At Pagosa Springs, Colo., artisian wells are driven to a depth of 380 ft., where a supply of hot water is obtained. This is run through the buildings in the manner shown in the diagram above, and continuously heats the buildings at practically no cost. Photo shows an artisian well just before it was capped and put into use.
—I. Pim, Reporter No. 4129.

Pneumatic Wheel



Arrow points to the pneumatic air cushion indicated in the drawing at 2. The tire is solid and is shown at 1. At 3 we find a protecting plate covering the air cushion which slides up and down on point 7. The air valve stem is shown at 5, while 6 is the steel disk holding the tire to rim 8 by bolts 9. —J. W. Von Stein.

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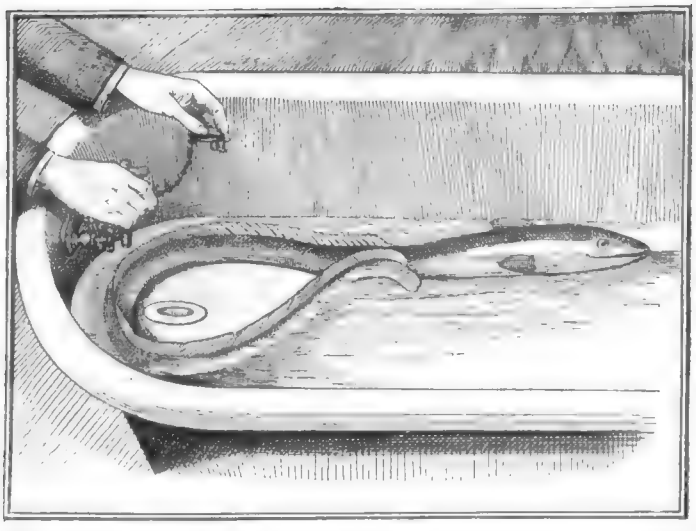
"Telegraph" Plant

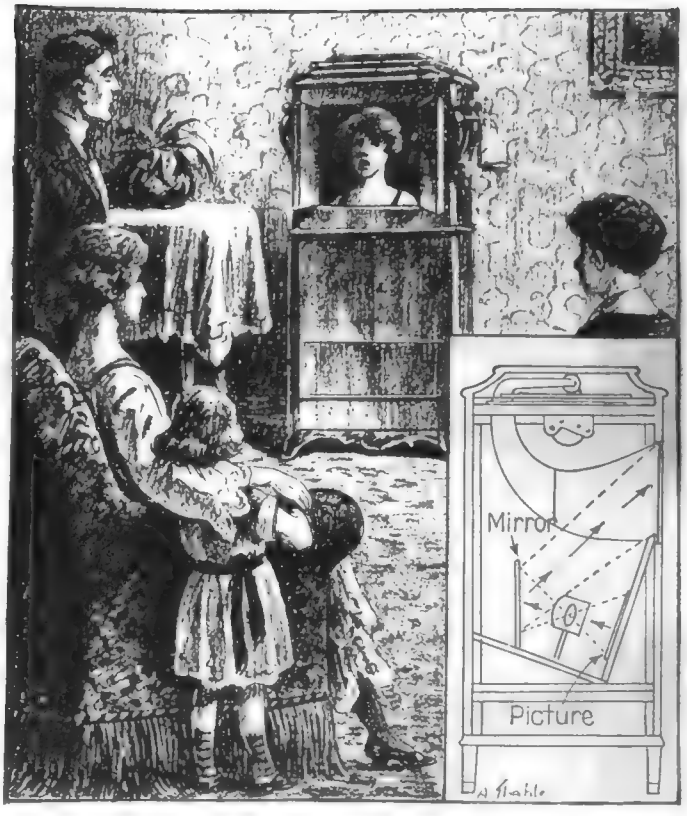
The plant shown in the above illustrations resembles a telegraph instrument in that the two small leaflets that grow on each side of the large central leaf are continually jumping and jerking. At night the plant "sleeps" by folding its leaves as shown in the photo to the left. Also, at the approach of a storm the plant follows the same course making it a good weather prophet. —S. L. Bastin.

Intelligence of Eel



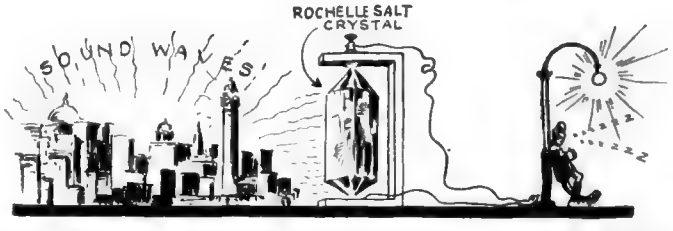
Kosmos, a German scientific journal, quotes an observation made by one of their readers which would seem to point to a more than usual degree of intelligence found in an eel. When the stopper of the bath tub in which he was living was removed he took care to preserve his life by using his tail as a dam as shown.

Phonograph Novelty



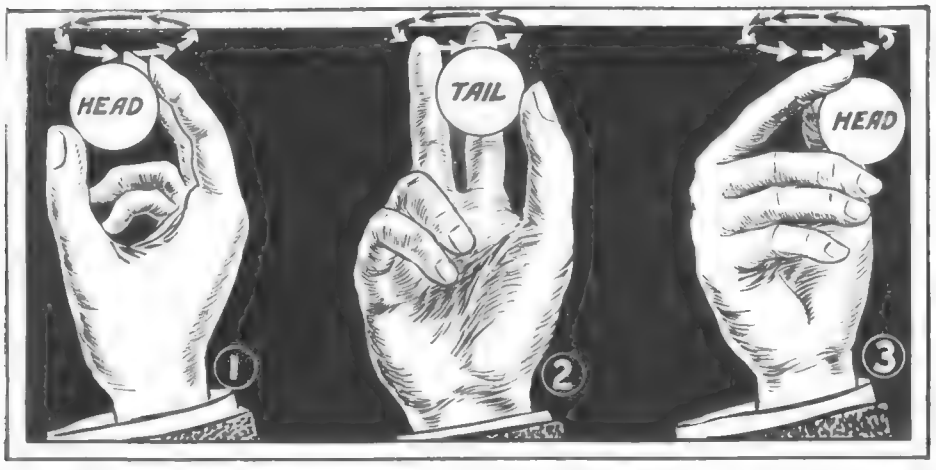
The inventor of this device, Robert A. Rummel, makes it possible to see the singer at the same time her record is heard on the phonograph. The device consists of a reflecting projector placed in the base of the musical instrument.

Watson! The Needle



Above is shown the bright idea of a Western inventor. He would supply the electric power needed by cities by putting their noise to work. As illustrated the noise impinging on a Rochelle Salt crystal would set up piezo-electricity.

Easily Performed Coin Trick



By the easily mastered manipulation illustrated in the above sketch one can convince on-lookers that a coin has a head on both sides. The coin is held between the thumb and forefinger and the hand is given a half turn. But while the hand is making the turn the coin is also given a half turn in the hand by shifting it from between the thumb and forefinger to a position between the first and second fingers. —Franklyn Kenchion.

Shoe Preserver

Castor oil is good for many things aside from its medical and electrical value. Above is shown another use. If a coat of it is applied to the soles of shoes it will not only leave the leather much more pliable but it will also increase its wearing qualities. —Ernst. Keil.

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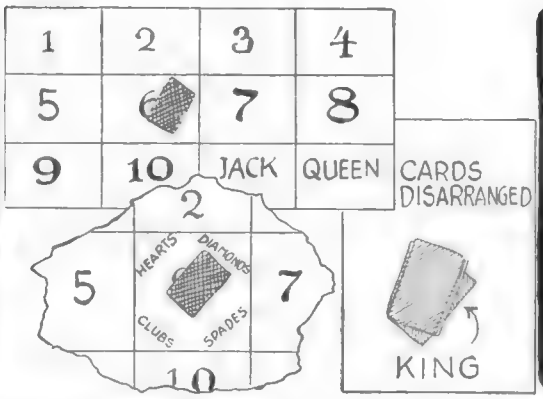
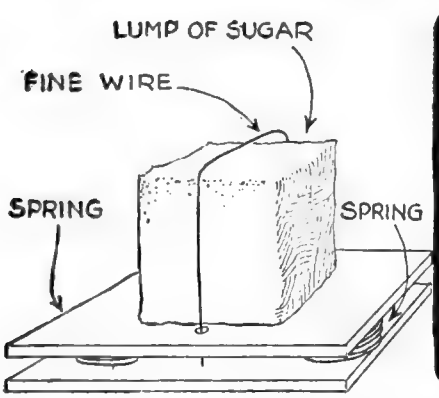
Magic for Everybody

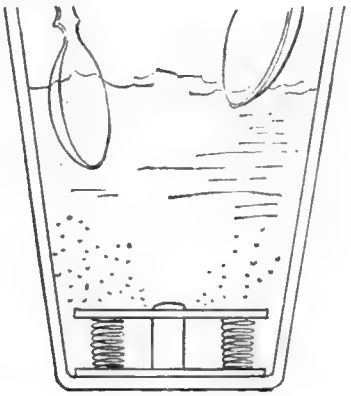
By Prof. JOSEPH DUNNINGER

NO. 18 OF A SERIES



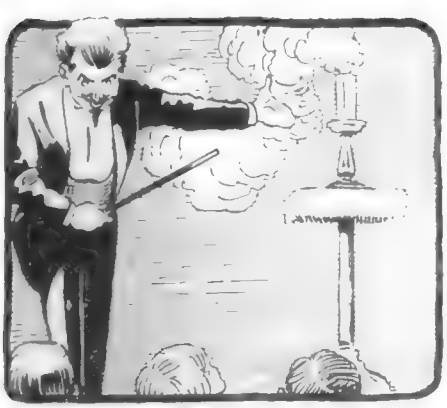
The magician requests that his assistant be blindfolded and leave the room. He now asks one of the audience to select a card from a pack, look at it and return it to the same. The cards are placed face downward on the table. The assistant returning, instantly names the card mentally selected. The magician placing the cards face downward on the table indicates the suit and value by their position on the table. The table is mentally divided up into sections as indicated. Disarranged cards mean a King.

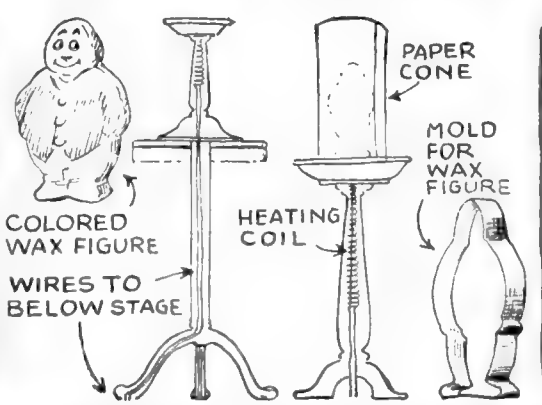


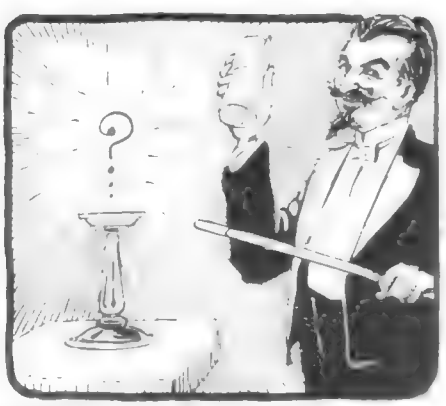


The magician puts two spoons into a glass, fills it with water and at his command the spoons fly upward into the air. The spring system used is illustrated above. A lump of sugar prevents it from acting until the sugar melts. The contents of the glass including the spring are then poured into the pitcher and the glass passed for examination.

The performer's mystic ring has the property of vanishing at his command. A puff of smoke and presto! The ring is gone. The ring is really a half ring. A rubber band is attached to one end and a flip of the thumb releases it from the finger. The ring slips into the performer's coat sleeve under cover of the cloud of smoke.







The figure shown above is solid and is passed around for examination. It is put on a stand and covered with a roll of paper. A little smoke indicates that the figure has vanished. Sh—the figure is wax and the heating coil in the stand melts it. The wiring is concealed in the candle-stick holder and passes down through a leg of the table.

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More Gamblers' Tricks Exposed

By MARK MELLEN

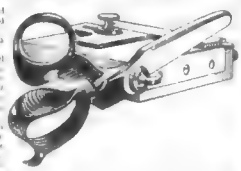
The Man Who Fooled P. T. Barnum

Above, the gentleman has just slipped all the aces from the deck preparatory to dealing himself one fine hand in a poker game. He is able to do it with the use of the shearing apparatus illustrated on this page. The tyro hasn't a chance in a game with slipped cards such as those used in the above illustration.

CARD sharps often use cards that are not uniform in size and shape, which are called sorts, wedges, strippers or high and low cards. They are made by trimming a sliver off the edge or at the end of the cards. For the game of banker and broker, which is simply cutting for the high card, every card from seven up is trimmed so that the edge is slightly concave. As the uninitiated player always picks his cards up from the center of the long side, he of course always cuts the low card and thus loses. The same plan is followed for other games. In poker the card's edges are trimmed so that the ace is cut. Strippers are cards trimmed in such a manner that certain ones of the deck can be stripped or pulled out without the act being detected. In this case, all the cards except those desired, say the aces, are trimmed by taking off a slight sliver of uniform width the full length of the card. The aces are then fixed with convex edges as shown, so that by simply grasping the cards in the usual fashion, the dealer, with one stroke, can pull the four aces from the deck. For playing euchre, the jacks are prepared thus, and for casino the two-spot of spades and the ten of diamonds. The cards are sometimes fixed so as to be wedge shaped, for in playing bridge-whist, it is an advantage to control the spades, in which case all spades will be made in the shape of wedges with the other cards slightly reduced. Thus the spades may be slipped from the deck. The illustrations show advertisements from catalogs of various card concerns for card trimming devices. However, decks already prepared in this way may be obtained from many houses already cut, thus saving the sharper the trouble of preparing the cards. Of course trimming the corners and sides is also used as a system for marking cards.

The gentleman above is in the act of shuffling the cards which have been trimmed. He can place high cards in any position in the deck. The gentleman below is trimming the deck.

PLAYING CARD TRIMMING SHEARS



THE PERFECTION CORNER CUTTER

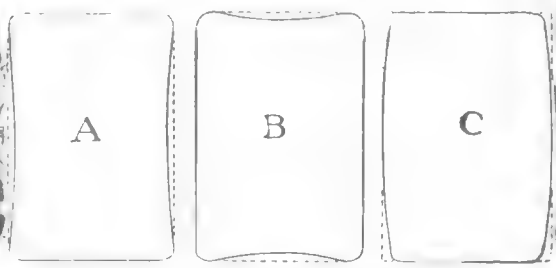
MADE AND SOLD BY US ONLY

This tool is made for rounding the corners of cards after trimming, giving the corners a neat and finished appearance. Made of brass and steel, nothing to get out of order, cuts absolutely accurate and is faster than any tool of this kind ever made, making the corners appear exactly the same as new cards. Weight, 1¼ pounds.

No. 20C236 ..... Each $28.50

NOVELTY CHARM POCKET PIECE

Most innocent looking is this pair of dice in a silver cage worn as a watch charm. However, they are not so innocent since they are both loaded. A hole is simply drilled beneath one of the spots filled with a heavy metal, and then the spot replaced and colored.



Above at A is shown a card trimmed with the side edges concave. At B the ends are made concave, and at C the edges convex. The dotted line shows the original shape of the card. By these expedients the card sharper when he is dealing, has almost absolute control of the deck. The sucker will do well to hold the cards about twenty inches from his eyes between his face and the light, and see that the deck is straight before playing. However, suckers see very little and what they see means practically nothing to them.

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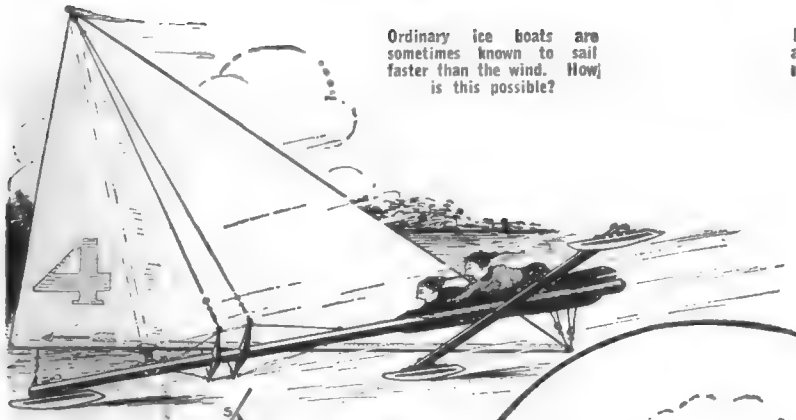
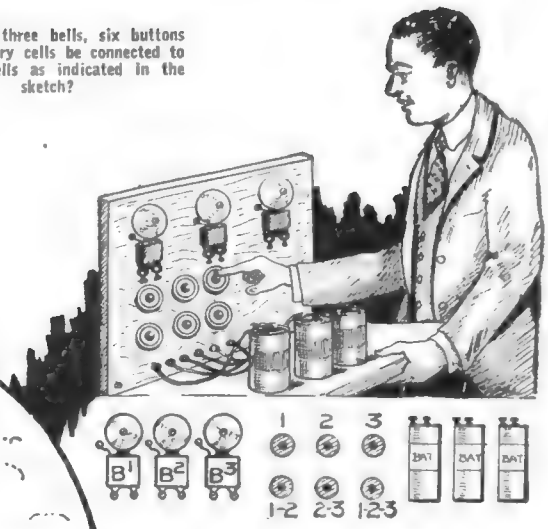
Scientific Problems and Puzzles

By ERNEST K. CHAPIN, M.A.

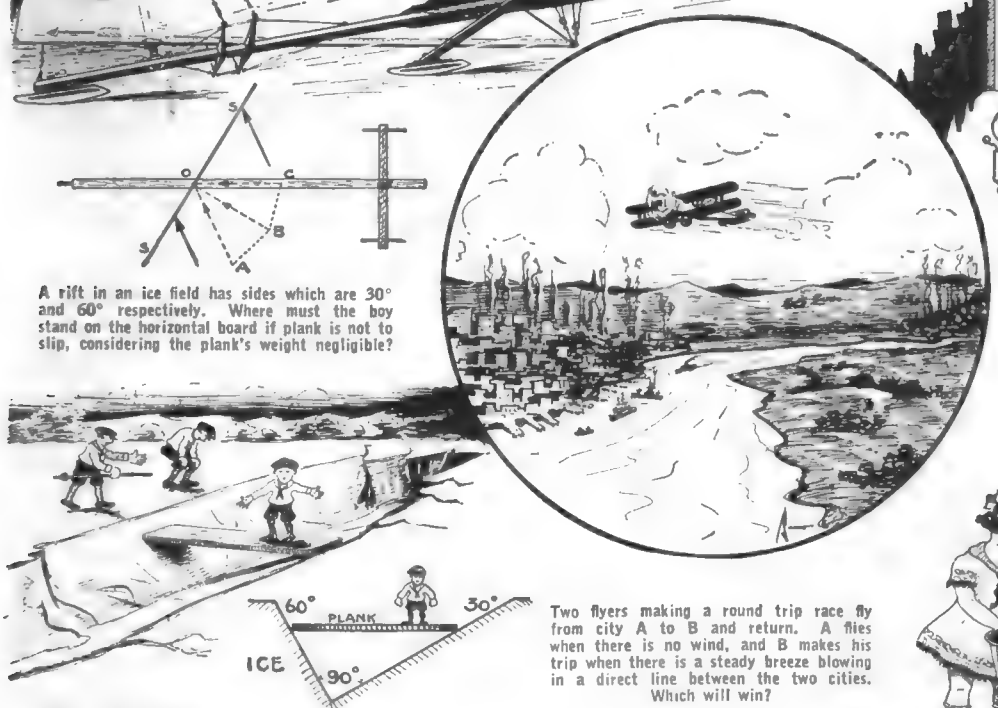
Ordinary ice boats are sometimes known to sail faster than the wind. How is this possible?



How could three bells, six buttons and three dry cells be connected to ring the bells as indicated in the sketch?

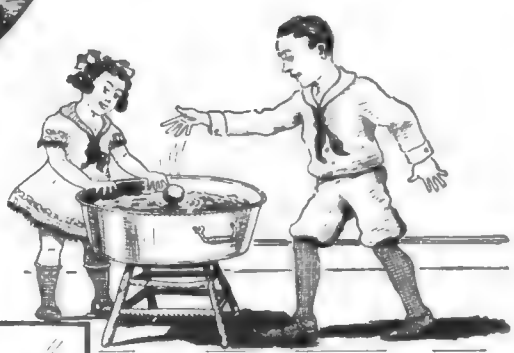


A rift in an ice field has sides which are 30° and 60° respectively. Where must the boy stand on the horizontal board if plank is not to slip, considering the plank's weight negligible?

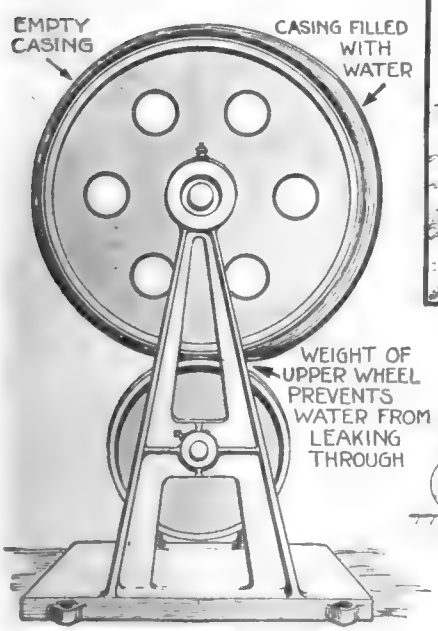


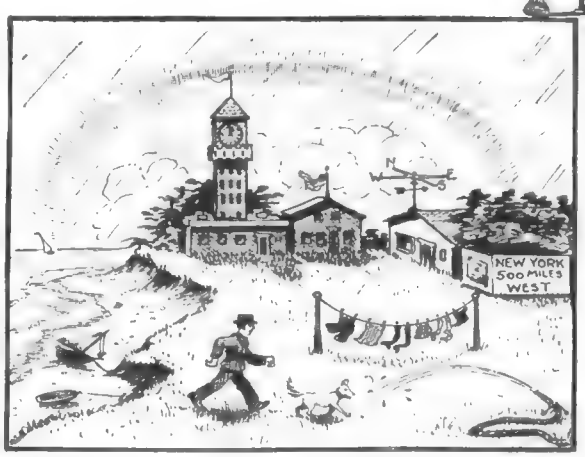
A ball is rotated about its horizontal axis and dropped in water at the same time. Will it sink straight down or be deflected, and in what direction?

Two flyers making a round trip race fly from city A to B and return. A flies when there is no wind, and B makes his trip when there is a steady breeze blowing in a direct line between the two cities. Which will win?

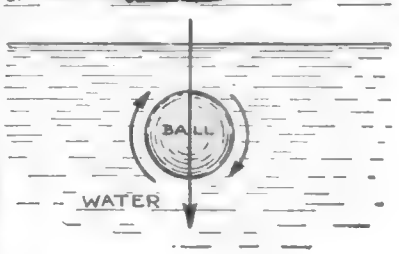


What's wrong with the idea below? The weight of the water in one side of the casing turns the wheel forever and ever, while the weight of the upper wheel prevents the water from leaking through where the two wheels come together.



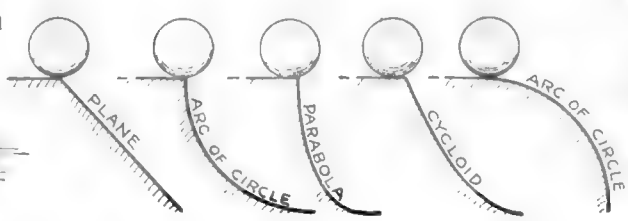


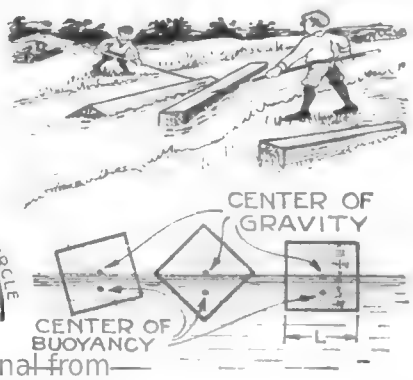
How many incorrectnesses are in the above picture?



The straight uniform beam square in cross-section floats half submerged in water. What position will it assume?

Considering the balls of equal weight in the sketch below, all of them being started simultaneously, which ball will reach the lower plane with the highest velocity?





(Answers to these problems given on page 503)

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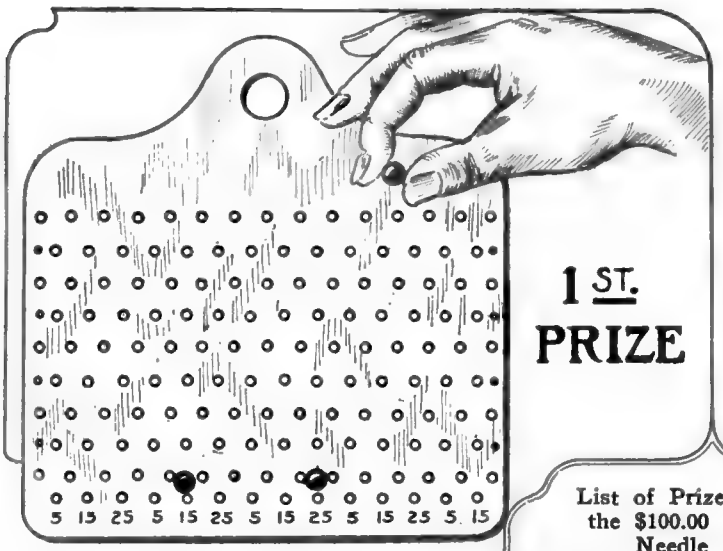
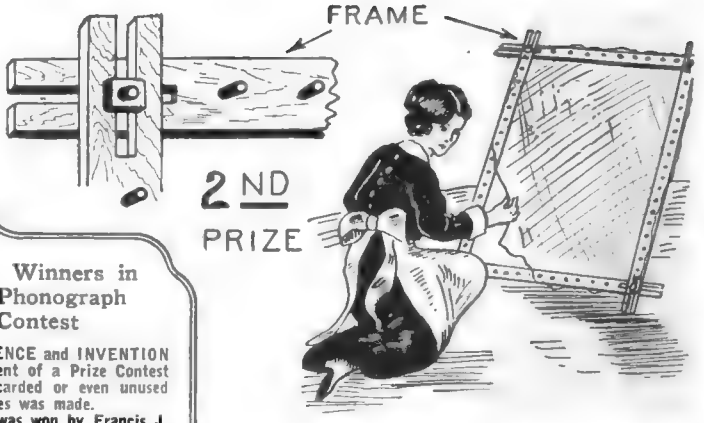
Awards in $100 Needle



1 ST. PRIZE



2 ND PRIZE

List of Prize Winners in the $100.00 Phonograph Needle Contest

IN the May issue of SCIENCE and INVENTION magazine an announcement of a Prize Contest for the best uses for discarded or even unused phonograph needles was made.

The first prize of $25.00 was won by Francis J. Lorenz at 426 E. Seneca St., Ithaca, N. Y., for the Game illustrated above. This is made of a piece of board into which the phonograph needles are driven as indicated. Steel balls are used, each player receiving five balls (which he drops in at the top), then totalling up his score. There are no wood shelves or other retainers for the balls except the needles themselves. Although several games were entered in this contest none can compare with this for simplicity or appeal.

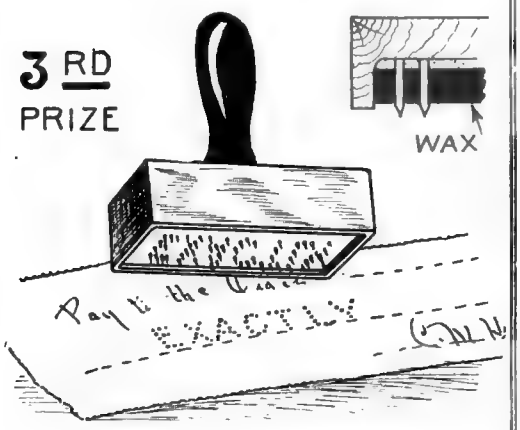
The second prize was won by Louis Orlando of New York City for the Curtain Stretcher illustrated above and to the right. Mr. Orland receives $20.00 second prize.

Mr. A. Zimmerman hailing from Toronto, Canada, wins the third prize of $15.00 with the Check Protector idea which he submitted. He pushes phonograph needles through a piece of cardboard forming the word "exactly." This cardboard strip is now placed in a suitable holder and molten sealing wax is allowed to pour into the holder until it comes within 1/16 inch of the protruding points. By forcing the stamp down upon the check, the check is punctured with the letters or numbers on it.

The state of Kansas supplies the next prize winner, who is Marion Caldwell from the city of Eldorado. A phonograph needle is driven into the end of a small piece of wood as indicated. When the point of the needle is inserted into the bottle cap and pried upward the cap comes out of the bottle very easily. The 4th prize for this idea, an award of $10.00, is therefore given to Mr. Caldwell.

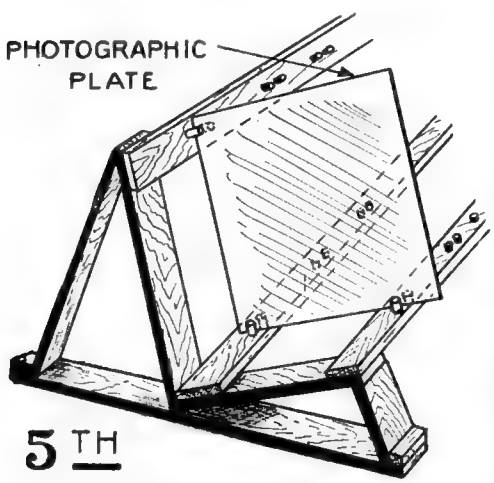
The fifth prize of $5.00 was won by Mr. P. C. v. Petegem of Rotterdam, Holland. He uses six needles for each plate in the wooden negative rack.

The sixth prize award of $5.00 goes to Mr. R. J. Shryock of Lexington, Ky., for the Spark Plug Tester here illustrated. The needles insure positive contact even through a thick coating of oil. For the seventh prize, also of $5.00, two contestants tie, consequently a prize of identical nature is given to both. The first is George R. Harding of Huntingdon, W. Va. The second is Jack Bront of Cleveland, Ohio. They both receive a reward of $5.00 for the screw driver in a jeweller's drill holder. The eighth prize for the glass drill made of a phonograph needle was won by Mr. L. Powell of San Francisco, Calif. Mr. Powell submitted some very pleasing examples of work done with such a drill and we are glad to award him the $5.00 prize. The ninth prize of $2.50 was won by Mr. L. Powell again. This is a gauge made of a knitting needle to the end of which are secured phonograph needles.

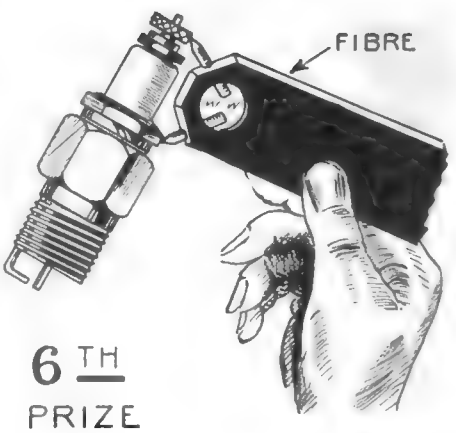


3 RD PRIZE

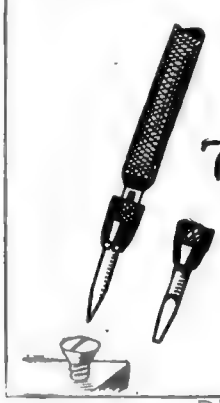
4 TH PRIZE



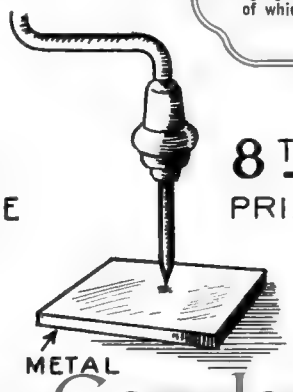
5 TH PRIZE



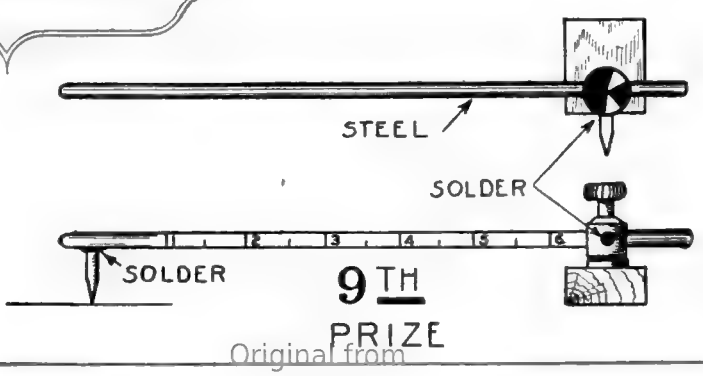
6 TH PRIZE



7 TH PRIZE



8 TH PRIZE



9 TH PRIZE

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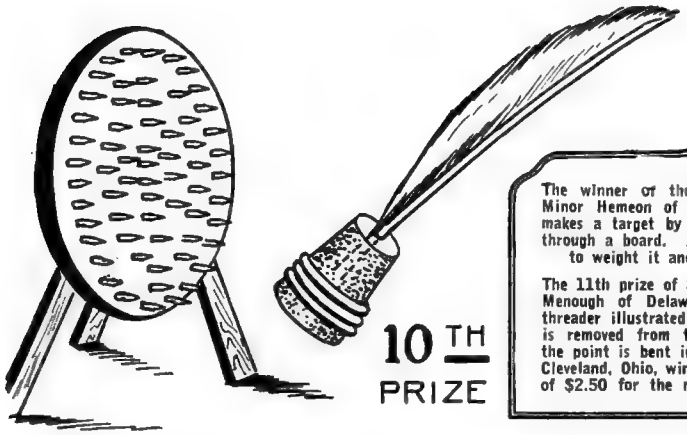
.00 Phonograph Contest

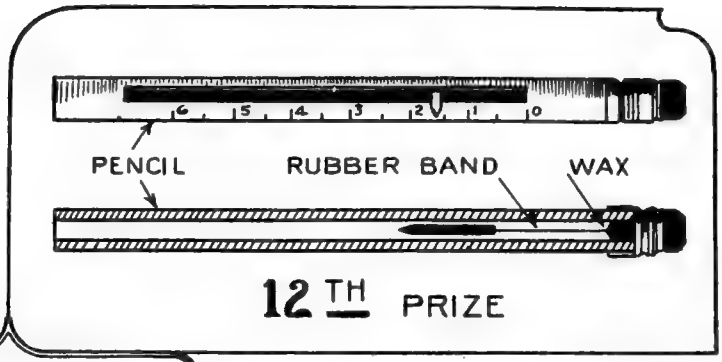


10 TH PRIZE

The winner of the 10th prize of $2.50 is Minor Hemeon of Nova Scotia, Canada. He makes a target by driving phonograph needles through a board. A cork with a rubber band to weight it and a feather is the dart.

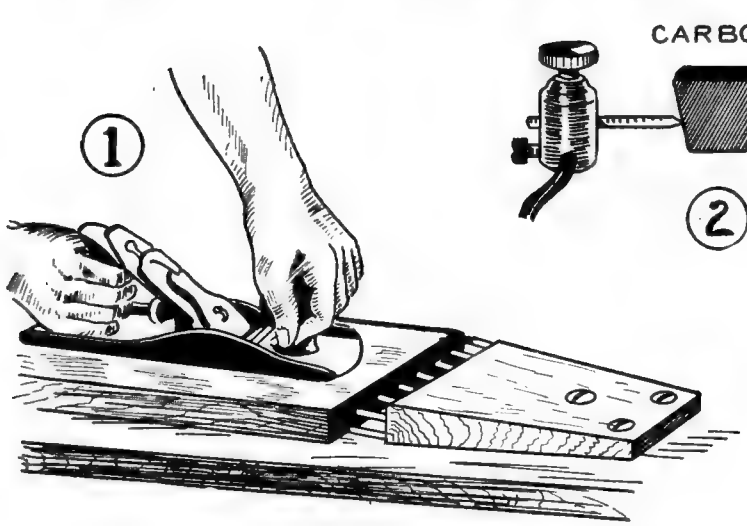
The 11th prize of $2.50 is awarded to Duane Menough of Delaware, Ohio, for the needle threader illustrated at the right. The temper is removed from the phonograph needle and the point is bent into a hook. Jack Bront of Cleveland, Ohio, wins the twelfth and last prize of $2.50 for the magnet tester shown above.

11 TH PRIZE



12 TH PRIZE

Honorable Mention



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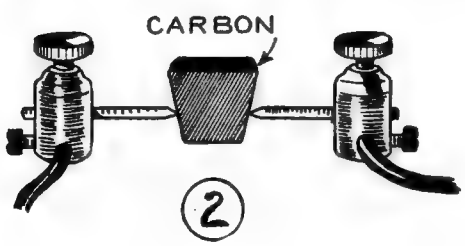

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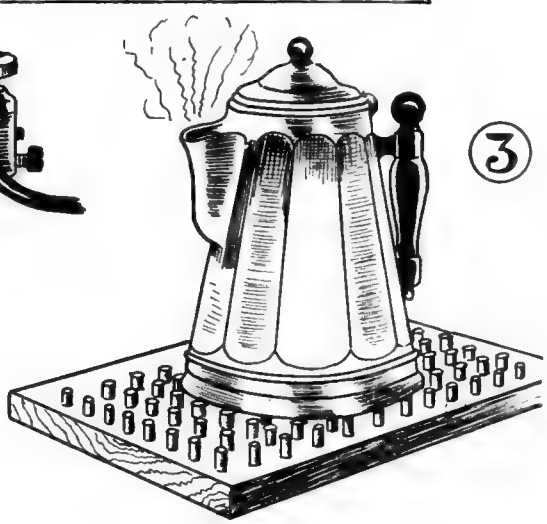

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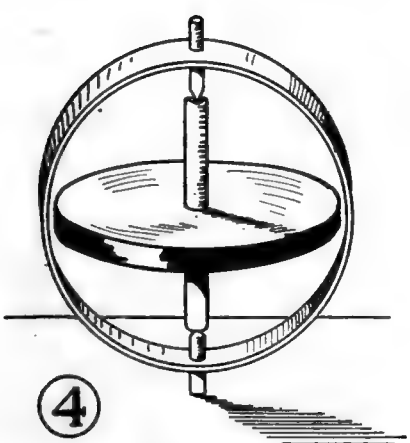

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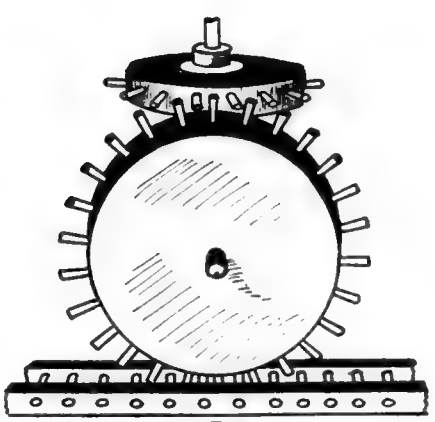

6

The first honorable mention is for the Bench Stop shown in Fig. 1 and goes to Leighton Powell, Reporter No. 8621, San Francisco, Calif. Paul Brietwich of Chicago, Ill., wins the second honorable mention with the microphone shown in Figure 2. The third honorable mention shown in Figure 3 is the Hot-Pot Holder. This was entered by Andrew Farina, Kamploops, B. C., Canada. The idea for Gyroscopic bearing shown in Figure 4 was also submitted by Jack Bront, whose name was previously mentioned. This suggestion gets fourth honorable mention. The fifth honorable mention for the Poison Bottle Top shown in Figure 5 goes to Olin Alvin Williams of Americus, Ga. It might be mentioned that Mr. Williams won the first prize in the Cigar Box Contest previously run by this magazine. Another fifth honorable mention for the same idea was awarded to D. B. McRae, Salt Lake City, Utah, and a third fifth honorable mention for the same suggestion to C. R. Mullin of Minneapolis, Minn. The last three mentioned names from different parts of the country submitted the same suggestion and tie for the honorary award, the gear and gear rack indicated in Fig. 6. The eighth honorable mention is awarded again to Mr. C. R. Mullin of Minneapolis, Minn.

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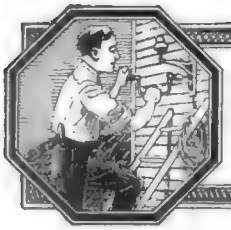
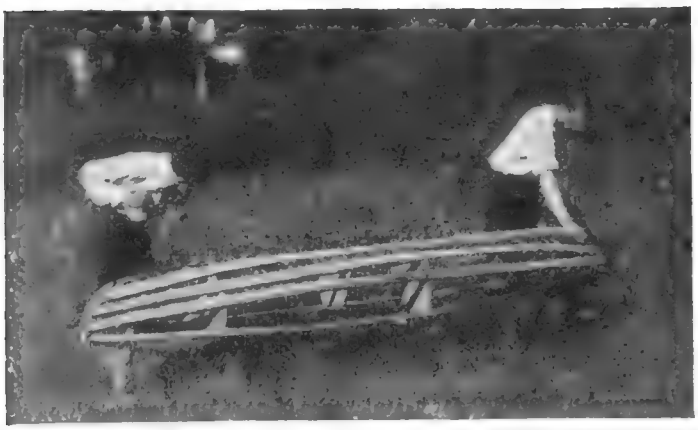
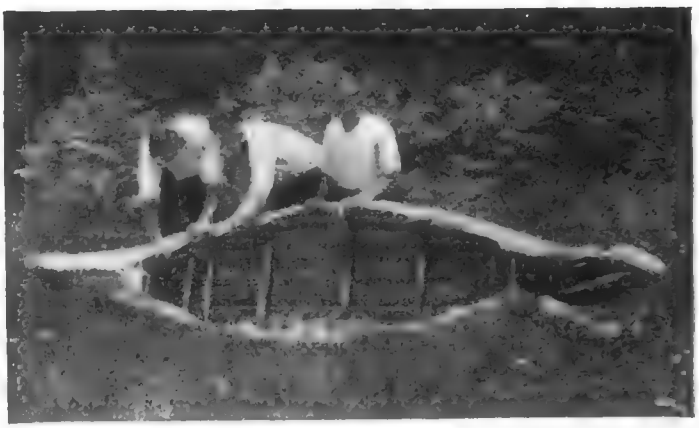


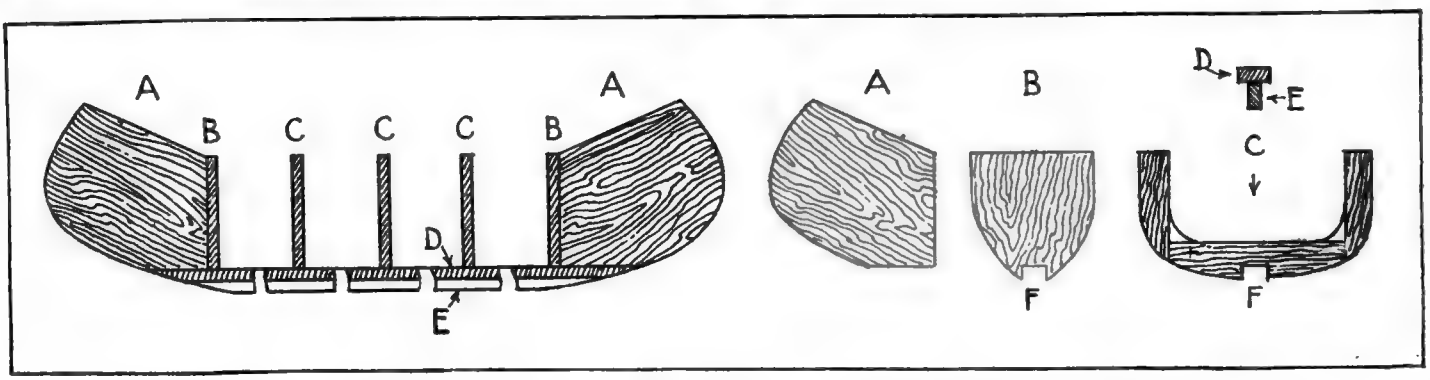
THE CONSTRUCTOR

Canvas Canoe Construction

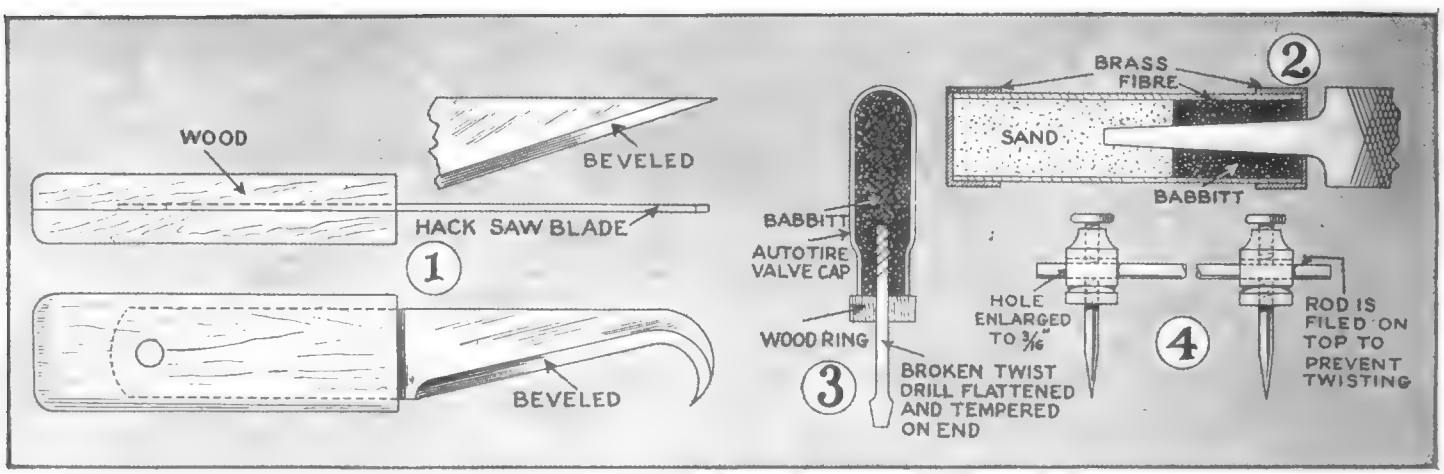
THE construction of the canoe shown in this article is extremely simple and may be carried out very easily. The length must first be decided upon. Fourteen feet will be ample for two persons. It may be shorter if only one person is to use it, or longer if more than two are to be carried. A good grade of cypress is used throughout. The keelson is first laid, and may consist of a strip of about three-quarters by one and three-quarters inch stock. To each end a stern and bow piece is attached, which are made of 5/8" stock. They are held in place by screws. Immediately behind these pieces, the bulk heads are placed. They are cut according to pattern shown at B. Bulk heads and cross braces are all notched, as at F. Cross braces are made by gluing and fastening three pieces of stock, as shown at C, bracing them with angle irons. Next the rib bands are bolted to the bow and stern pieces and tacked to the cross braces. These braces are 1/4" by 1 1/4" stock, a little longer than the canoe length. The front portions should be soaked in hot water before application, so that they will be pliable. The canvas is then stretched over the frame in one piece, tacked to the keelson, rib bands and gunwale. The keel is then nailed to the bottom of the keelson. The canvas is painted with about three coats of paint rich in oil. —Dr. Ernest Bade.







Uses for Broken Tools



A hack saw blade cut as at 1 and equipped with a handle makes an excellent tool for cutting linoleum or roofing paper. An old fuse plug filled with sand and babbitt serves well as a file handle, while a broken drill, a little babbitt and an auto tire valve cap make a screw driver. Binding posts are good trammel points, see Fig. 4. —T. B. Sage.

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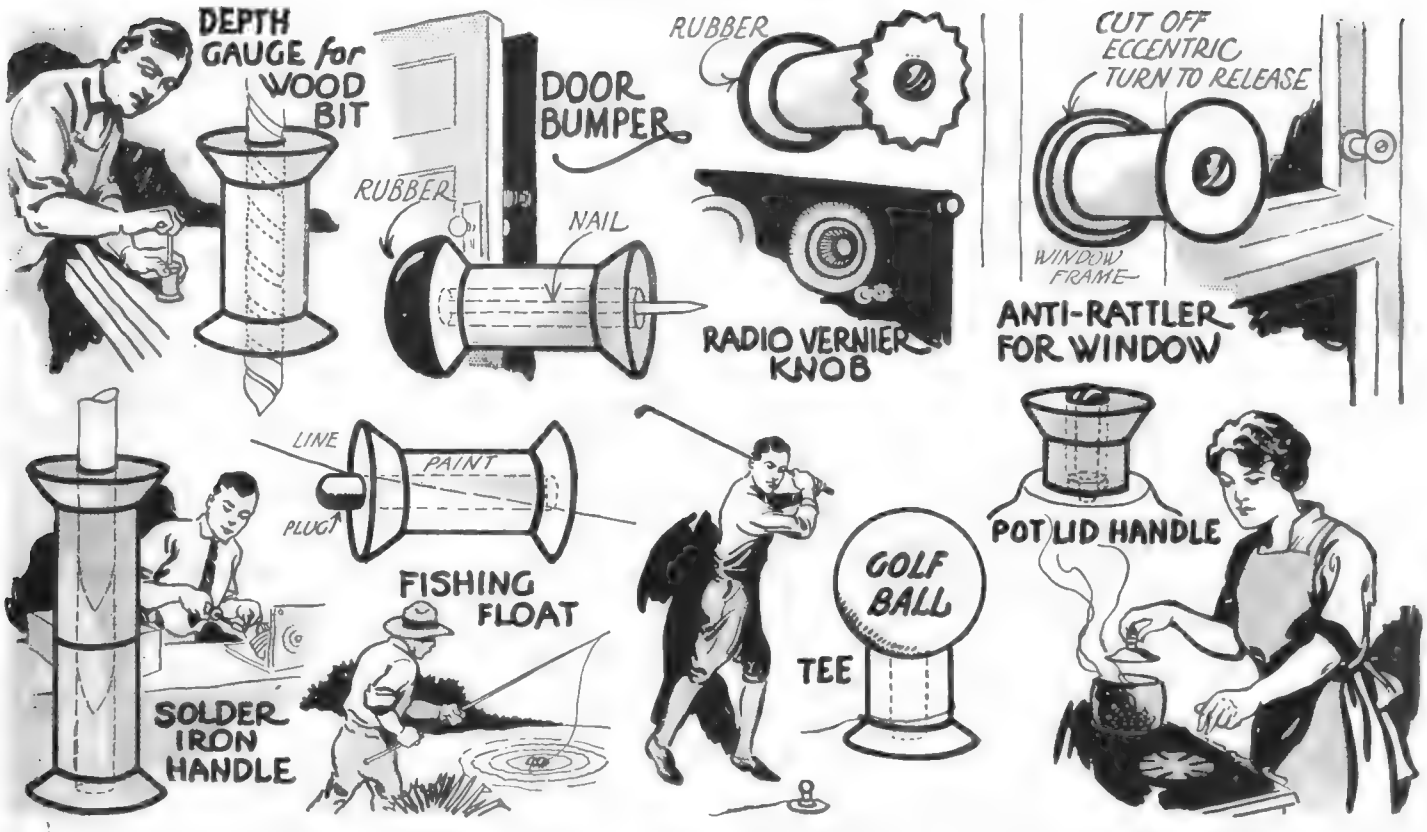
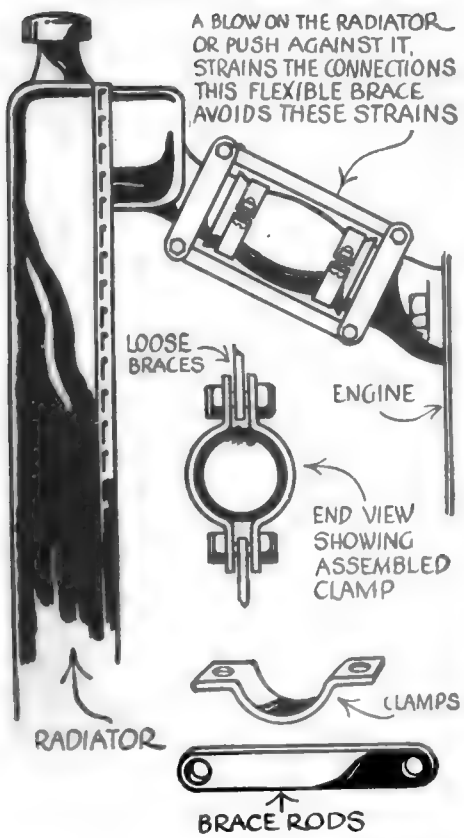
Uses for Old Spools

By WALTER MARKOWSKI



Old spools can be put to so many uses that one really wonders why they are thrown away. These suggestions shown in the illustration above do not complete the number of purposes to which empty spools admirably lend themselves. The enterprising reader will find no difficulty in discovering other useful applications. In the anti-window-rattler shown one side of the spool is cut off eccentrically and then the spool is mounted near the window frame. By turning it, a wedge-like fit is produced between window sash and frame so that it will not rattle. As the fishing float the line is passed through the center of a spool and held in place by a wooden plug.

Hose Kink


A BLOW ON THE RADIATOR OR PUSH AGAINST IT, STRAINS THE CONNECTIONS THIS FLEXIBLE BRACE AVOIDS THESE STRAINS
LOOSE BRACES
ENGINE
END VIEW SHOWING ASSEMBLED CLAMP
CLAMPS
RADIATOR
BRACE RODS

An elastic brace to prevent the straining of the hose connections leading to the radiator of a car is simple to construct. It will prevent the radiator from working loose by linking it with the engine.

—G. A. Luers.

Microscopic Drawing

Micro-photography is sometimes a difficult and expensive process. Many times the details most desired are lost. In the method shown above, those particular parts which are wanted may be drawn and colored. Coloring is a beauty unobtainable with the photographic methods. A compound microscope is placed on its side. A small piece of mirror is then fastened to the eye-piece with wax. This mirror should be at an angle of 45 degrees with the eye-piece. Both eyes are open and the operator looks into the mirror. The image greatly magnified will appear to be actually on the paper, and its outline can readily be traced.

—Prentice E. Tugardin.

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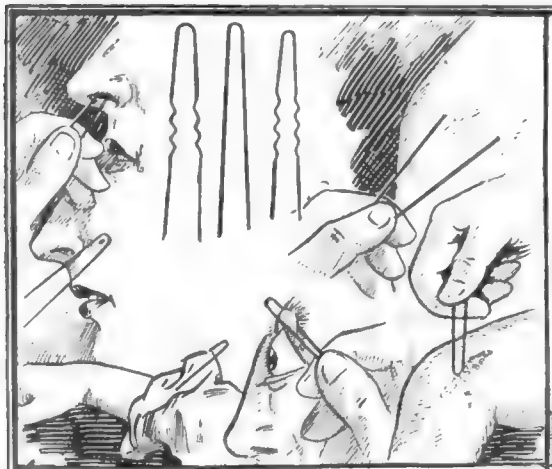
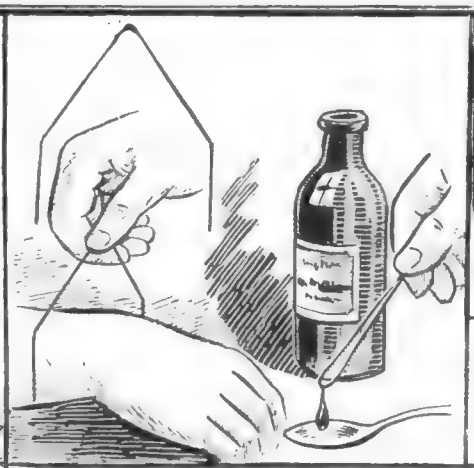
Hairpin Surgical Instruments

Nature of Pin Lends Itself Well to First Aid Work

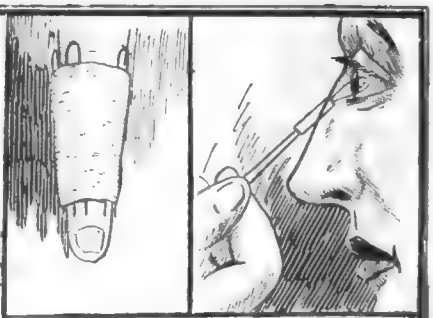
By W. C. MICHEL



Because of its ability to be thoroughly sterilized, the hairpin lends itself conveniently to a number of medical purposes. Above it is shown being used to remove foreign objects from the nose or ear, for holding the eye-lid open, and for squeezing small boils and scratching away scar tissue.

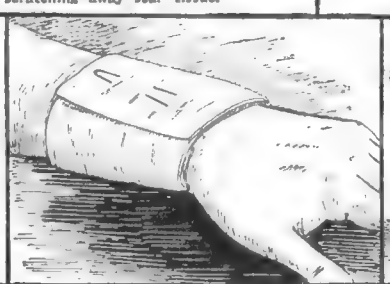


A hairpin is bent as shown at the left of the above illustration, and used as a pair of calipers for comparing the swelled member with a member in good condition. If the loop of the pin is bent together, it makes an excellent medicine dropper.

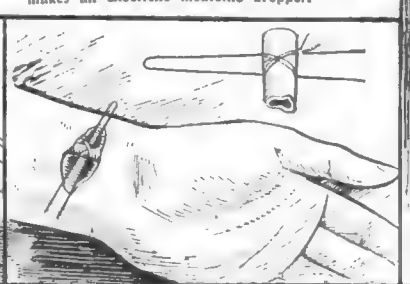


Another very handy use of this wire instrument, is for removing foreign particles from the eye. A hair or very fine thread is looped and attached to the loop end of the pin with adhesive tape or string. The loop thus formed is used to extract the foreign matter. For first aid work on a broken finger, toe, or other small member, the hairpin lends itself most handily as a splint.

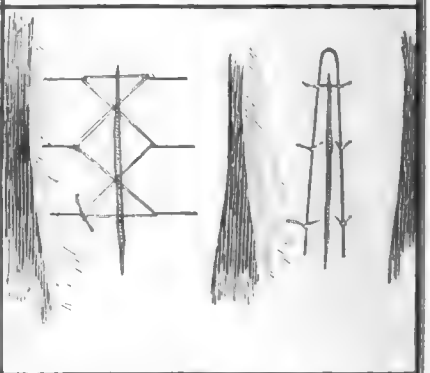
Placed as shown the hairpin is most effective in stopping a slight nose bleed.



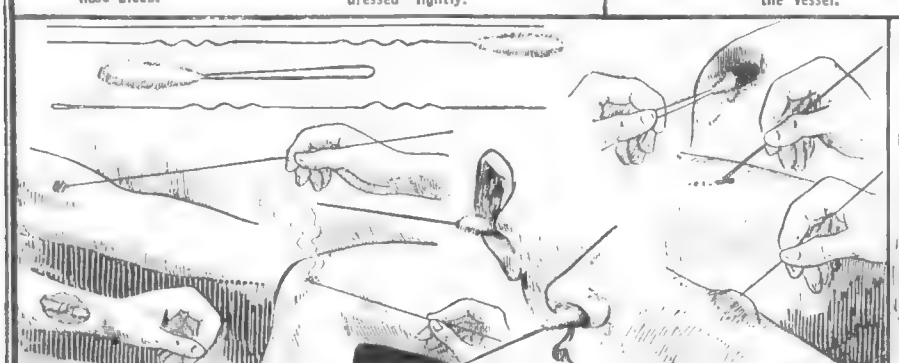
In default of safety pins or other binding material the hairpin is especially good where the wound to be bound must be left dressed lightly.



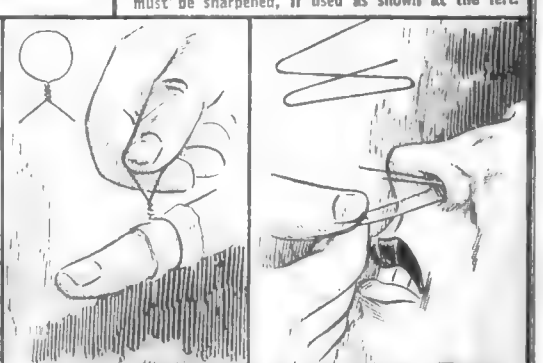
When a cut ruptures a blood vessel, the pin may be inserted under the vessel and a figure-of-eight ligature is lashed around the pin and the vessel.



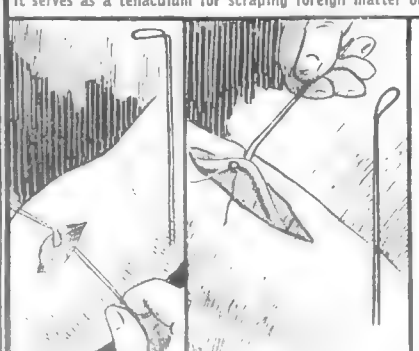
For long slits and cuts where the lips of the wound must be held together. The hairpin is supplemented by silk thread or catgut. The pin must be sharpened, if used as shown at the left.



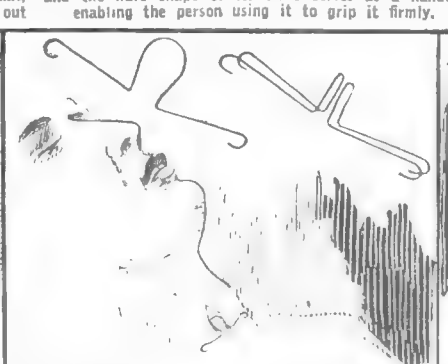
Here is shown a number of small but very important uses. With a bit of cotton wound around its end, an excellent swab is formed. By heating the end, it makes a cauterizing instrument. If one end is sharpened flat, it serves as a tenaculum for scraping foreign matter out of wounds. The other end of the same pin may be filed to a round point and used for opening boils and blisters. Its flexibility is a help rather than hindrance and the wave shape of its sides serves as a handle, enabling the person using it to grip it firmly.



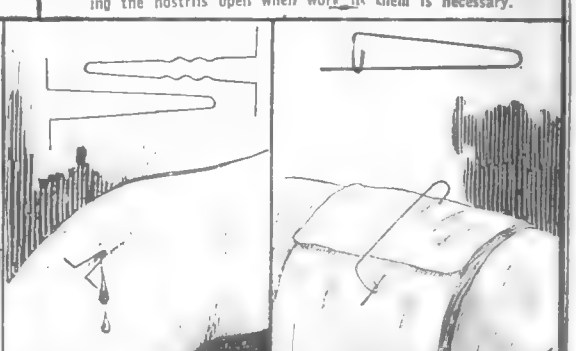
A hairpin properly twisted may be made to serve any purpose. A most handy tourniquet is made by simply twisting the hairpin in place of the regular instrument as shown. Also, bent in the form illustrated above, at the right, it can be used for holding the nostrils open when work in them is necessary.



Bent in the shape shown directly above, an almost perfect retractor is made. Many times bad wounds must be held open or a blood vessel must be raised from an open cut in the process of treating it. A slight loop on the end in the pin in the form of a hook allows its use in this position.



In dressing some peculiar wounds, such as those of trachea, it is necessary to hold the wound open for some time. In such cases a single hairpin or two bent in the shape shown at the top of the above illustration, fit in and perform this necessary function



In other wounds it is necessary to keep them open so that there will be a free passage for pus during the early stages of healing. A bent hairpin acts here very well. In a pinch, bent as shown in the right illustration, the hairpin can be made to serve as an excellent safety pin.

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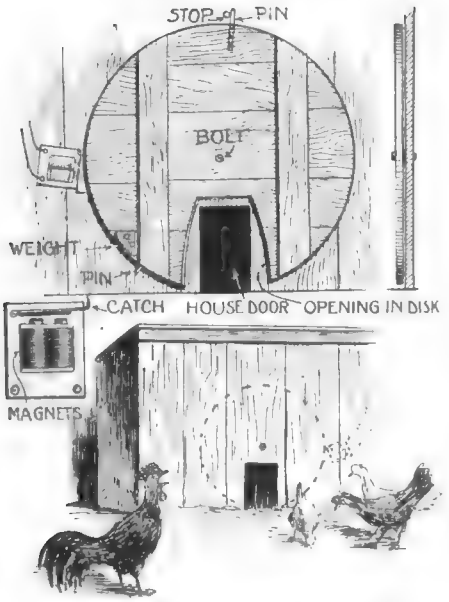
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.
The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded; for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

Coop Lock

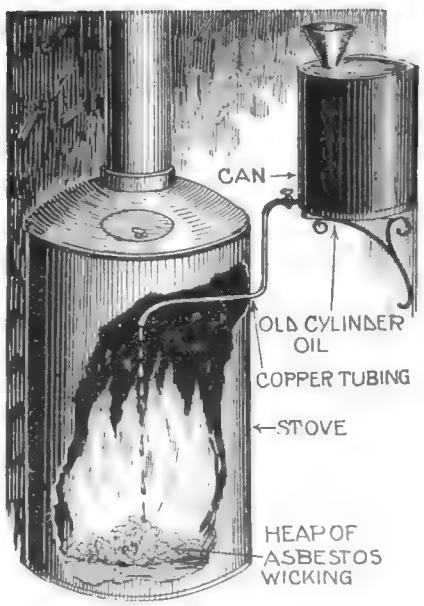
FIRST PRIZE $15.



The head of a barrel to which a weight is attached, an electro-magnet, the armature of which is equipped with a hook and a bolt, make an excellent automatically opening chicken coop if they are worked together, as shown in the above sketch. The weight rotates the door to the open position, as soon as the electro-magnet is energized, releasing the catch.
—L. B. Robbins.

Waste Oil Burner

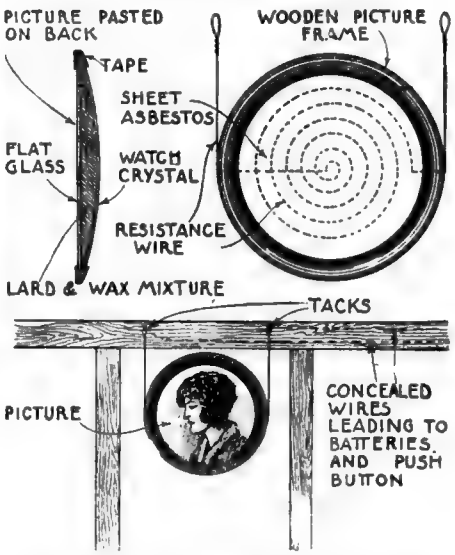
SECOND PRIZE $10



Waste oil may be burned with advantage through the method depicted above. A heap of asbestos wicking is thrown on the grates. The oil container is placed above the stove, and a small pipe carries the oil into the top of the stove, allowing it to drip on the wicking. The pet-cock controls the rate of flow.
—Leslie J. Smith.

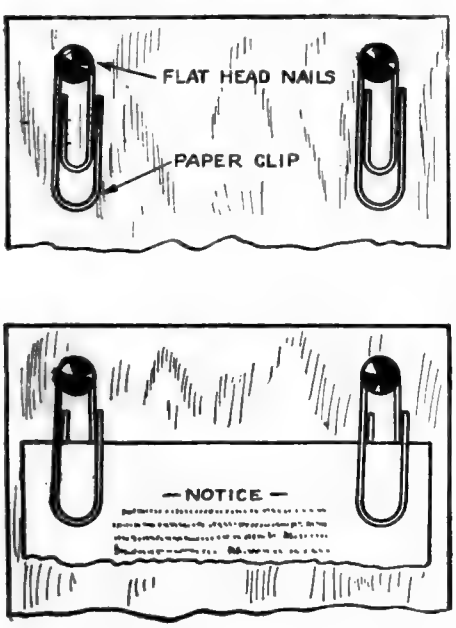
Spirit Picture

THIRD PRIZE $5



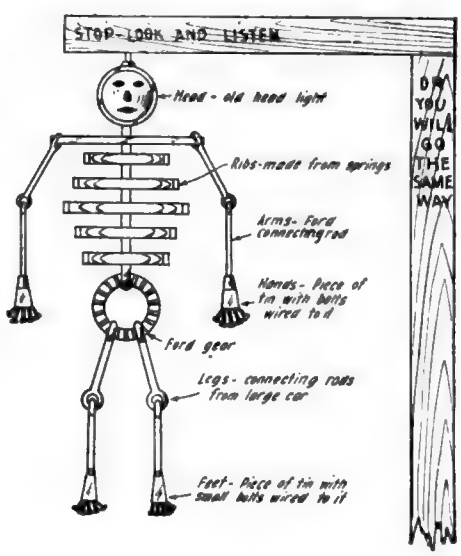
A photograph or view is pasted to a piece of thin circular glass. Over this is placed a four inch watch crystal, and the space between them is filled with a mixture of lard and soft white wax. The two are then taped together. On the back of the rear glass a coil of fine German silver resistance wire is wound and terminated in two loops. A current passed through the wire heats and melts the wax, making the picture visible. Upon cooling, the picture again disappears. This is a good parlor stunt. —Chas. D. Tenney.

Clip Kink



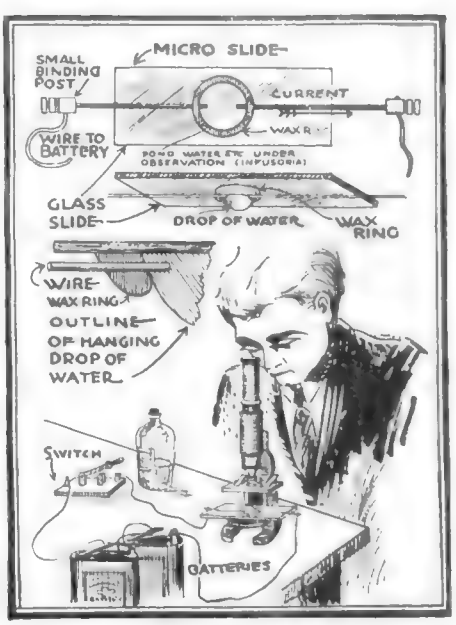
Where a great many notices are to be posted on bulletin boards, the trick illustrated above will come in exceptionally handy. Two ordinary paper clips are held to the board by flat-headed nails or large thumb tacks. The notice is then simply slipped into the clips. —Wilson Walters.

Warning


STOP-LOOK AND LISTEN
OR YOU WILL GO THE SAME WAY
Head - old head light
Ribs-made from springs
Arms- Ford connecting rod
Hands- Piece of tin with bolts wired to it
Ford gear
Legs- connecting rods from large car
Feet- Piece of tin with small bolts wired to it

One of the most novel methods of calling the attention of passing motorists to dangerous grade crossings, cross-roads or dangerous curves is a sign such as the one shown in the above illustration constructed from old automobile parts. It very eloquently conveys a message, which all the signs made of words known to man would never "put across." —Lyman Mason.

Microscope Kink



In observing the infusoria of water, the small bodies many times pass out of the range of observation. The two wires leading a current into the water, and attached to a small battery, may be used to electrocute them at the proper moment, thus making observation much easier. —C. A. Oldroyd.

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WRINKLES
RECIPES & FORMULAS

Edited by S. GERNSBACK

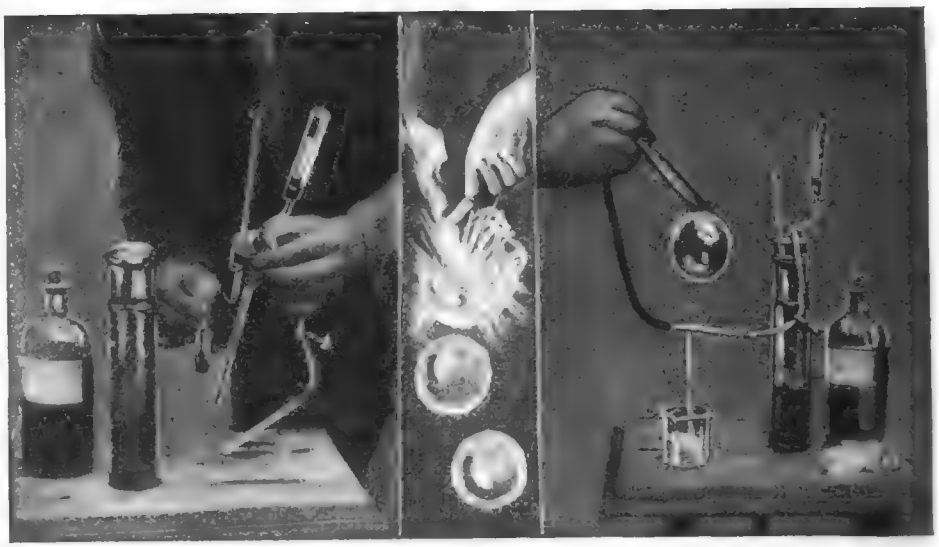
Bleacher

Process of Making Sulphuric Acid.

IF a bit of sulphur is ignited and plunged into a bottle of oxygen, the bottle will be speedily filled with fumes of sulphurous acid gas, which has powerful bleaching properties. If wet flowers, or damp red cloth, are held over the mouth of the bottle, the colors in them will quickly disappear. If care is used, this bleacher can be used to advantage around the household. The experiment may be performed very easily by using a large bottle as a container for the oxygen and only a small piece of lighted sulphur need be used. Every experimenter has the apparatus around his laboratory for making the oxygen, and has no doubt prepared it many times, so no details will be given here for its manufacture.

—C. Gauer.

High Pressure Hydrogen Generator

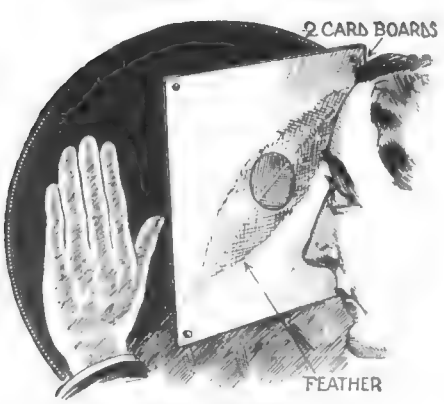


Above is shown the apparatus and arrangement for the high pressure hydrogen generator. It is the most economical and safest means of generating gas for the amateur.

A SIMPLE, and effective way to produce hydrogen, is by means of a chemical generator using zinc or iron and acid. The only apparatus needed is an olive jar, a three-holed and a one-holed rubber stopper, a vial, test tube, glass rod and tubing and some lead wires. A piece of the glass tubing is passed through one hole of the three-holed stopper which must fit the olive jar, and one end is bent into a handle and the other lower end into a hook. Then the test tube is carefully heated and five or six holes punctured through its bottom. The lead wire is bent around the tube and hooked on the glass rod. A second piece of glass tubing about two inches longer than the bottle, is passed through the remaining holes of the jar, and the vial with the one-holed cork placed on the upper end as shown. A delivery tube goes in the third hole of the main stopper. To operate, fill the test tube with iron or zinc and the bottle with sulphuric acid dilute about four water to one acid. The test tube is slowly lowered into the acid until acid just enters the first hole. Gas generation is controlled by raising and lowering this tube. A bit of copper sulphate dropped into the generator will improve its action.

—Dr. Ernest Bade.

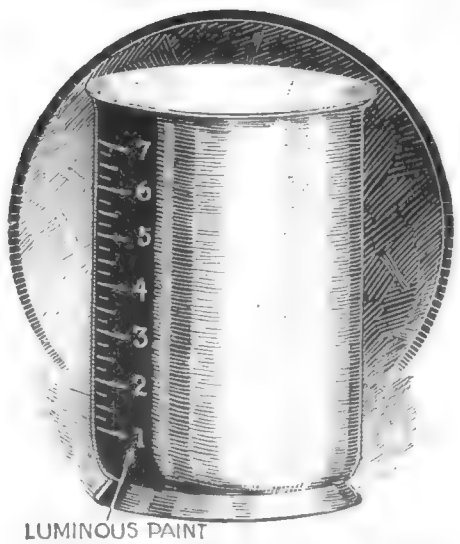
Feather "X-Ray"



A well known optical illusion may be performed with the assistance of a feather and a couple of pieces of cardboard. A clean regular feather is taken, as shown in the illustration, and placed upon a piece of cardboard, in the center of which a hole has been cut. On top of this is placed a second piece of cardboard similar to the first, and the two are fastened together. If the hand or a pencil is viewed through the feather, most astonishing results will be manifested.

—Frank R. Merre.

Graduate Kink



For working with graduates in dark rooms or with black liquids, procedure will be greatly facilitated, if the numbers and markings on the graduate are painted with luminous paint, as shown in the illustration. In fact this kink will be found most handy to any experimenter, since the red or black markings usually on the graduates are hard to read.

—J. H. Paulson.

Pen Lamp

Take four pen points and secure them around a cork with a hole in the center, as in the drawing. Take a match, place it over a lighted spirit lamp and allow it to burn for a few seconds. Then extinguish it and you will find at the point of it very fine white ashes. Place some of these ashes at the points of the pens. When the lamp is lighted again a very vivid bright light will result.

—Ben Zyl.

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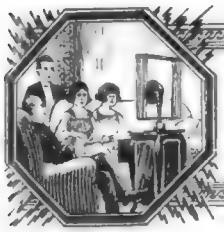
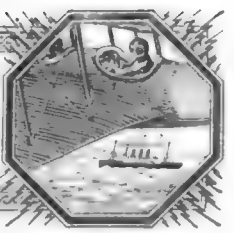
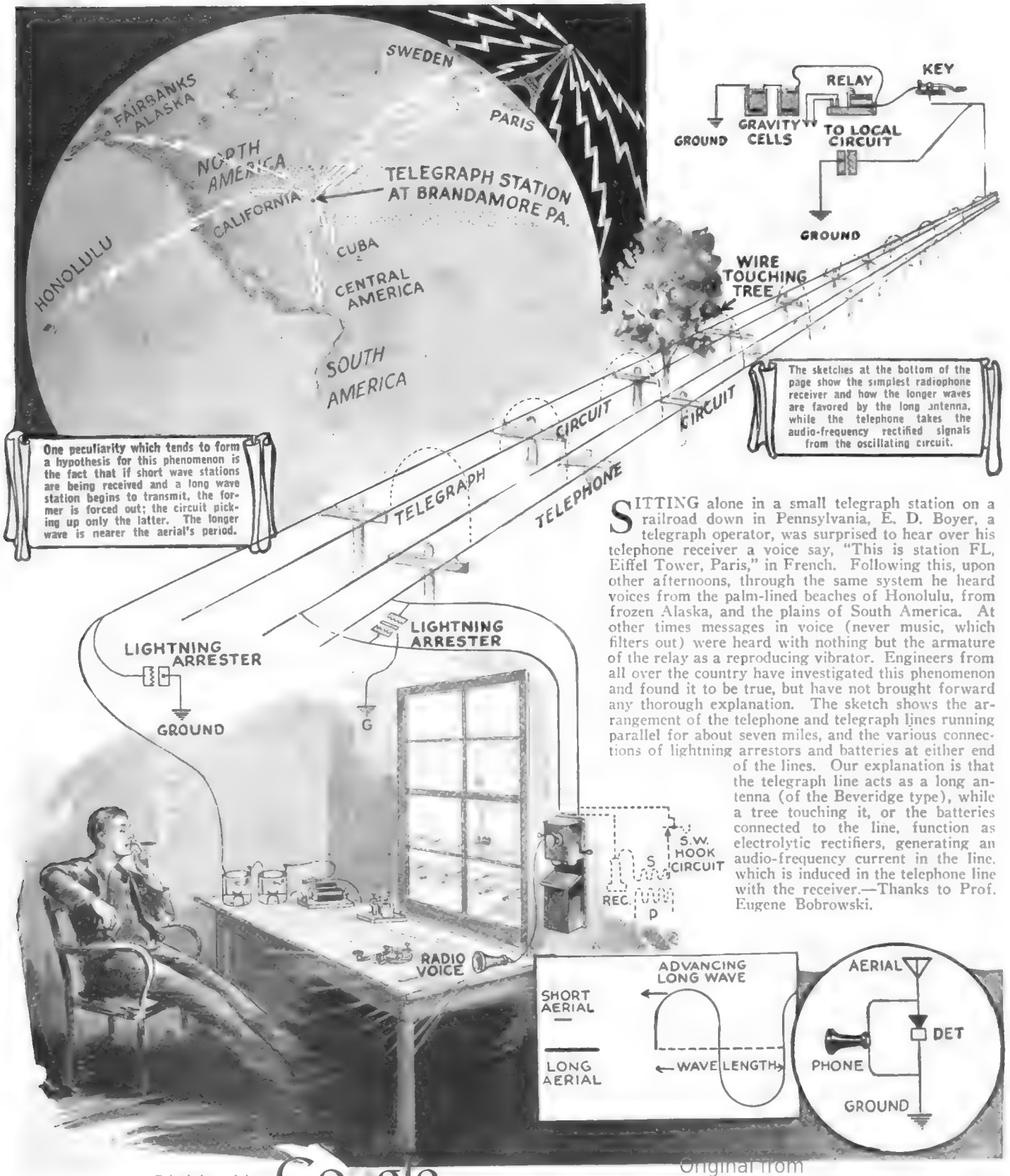


RADIO



Telegraph Circuit Receives Radio



One peculiarity which tends to form a hypothesis for this phenomenon is the fact that if short wave stations are being received and a long wave station begins to transmit, the former is forced out; the circuit picking up only the latter. The longer wave is nearer the aerial's period.

The sketches at the bottom of the page show the simplest radiophone receiver and how the longer waves are favored by the long antenna, while the telephone takes the audio-frequency rectified signals from the oscillating circuit.

SITTING alone in a small telegraph station on a railroad down in Pennsylvania, E. D. Boyer, a telegraph operator, was surprised to hear over his telephone receiver a voice say, "This is station FL, Eiffel Tower, Paris," in French. Following this, upon other afternoons, through the same system he heard voices from the palm-lined beaches of Honolulu, from frozen Alaska, and the plains of South America. At other times messages in voice (never music, which filters out) were heard with nothing but the armature of the relay as a reproducing vibrator. Engineers from all over the country have investigated this phenomenon and found it to be true, but have not brought forward any thorough explanation. The sketch shows the arrangement of the telephone and telegraph lines running parallel for about seven miles, and the various connections of lightning arrestors and batteries at either end of the lines. Our explanation is that the telegraph line acts as a long antenna (of the Beveridge type), while a tree touching it, or the batteries connected to the line, function as electrolytic rectifiers, generating an audio-frequency current in the line, which is induced in the telephone line with the receiver.—Thanks to Prof. Eugene Bobrowski.

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How Radio Drama Is Made

New Art Developed at Station WGY

WITH the introduction of the movies, a whole new system of drama was necessitated. With no voice to carry the development of the plot, many refinements in acting were incorporated. So with radio. The first step in the direction of evolving a new art—radio drama—has been made by the General Electric Company's station WGY, located at Schenectady, N. Y. Since the listeners do not have the advantage of the usual stage sets, scenery and business, it is necessary that every use be made of sounds to portray the dramatic intent of the words and actions of the characters, if the emotional properties of the new art are to pass above the stage of a bed-time story. The illustrations on this page show the first developments. True, a good many of them are copied from standard stage practice. However, even these must be adapted to the peculiar nature of radio. Their first attempts showed a fair amount of success, as demonstrated by the large number of laudatory letters received by the station after their first essay into this new art.

HOW THE SCENE IS PRODUCED

FIG. I.

ONE IMAGINES THE ACTION GOING ON IS AS SHOWN IN SCENES "A" "B" "C" AND "D"

FIG. II

EFFECT OF RAIN FALLING — OBTAINED BY ROLLING PEAS THROUGH PAPER TUBE

FIG. III

BELL BOARD ON RUBBER WHEELS

FIG. IV FOREST FIRE EFFECT OBTAINED THUS

GASOLINE TORCH MICROPHONE CRUMPLED PAPER MATCHES BEING BROKEN

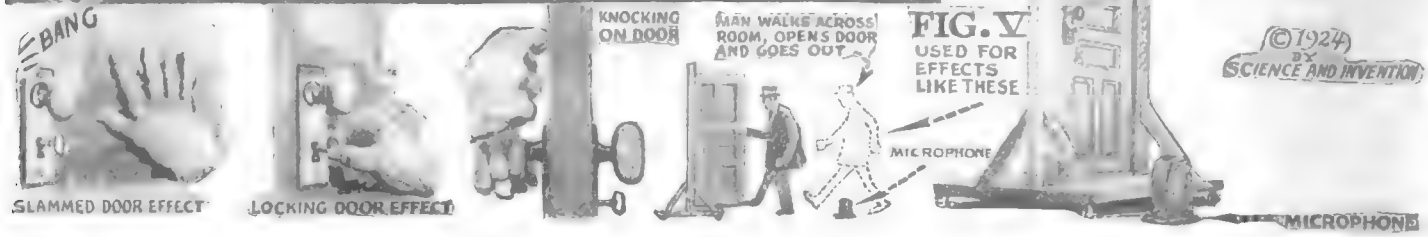

FIG. V USED FOR EFFECTS LIKE THESE

SLAMMED DOOR EFFECT LOCKING DOOR EFFECT

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The upper part of the illustration, Fig. 1, shows the simplicity with which a scene is produced. The audience, however, gets all the thrill of a good old-fashioned melodrama through one sense only, namely, their hearing. The hero is shot from ambush. He falls and feigns death. His assailant comes from hiding to look at his victim. Immediately the hero is on him. They fight in the autumn leaves which are on the ground. Shortly the heroine rides by. The hero gains the upper hand, and they ride away to other adventures. Many of the actions, as will be seen, are carried out to some extent. The struggle in the studio is performed in a large batch of onion skin paper to give the effect of rustling leaves. The various noises of men struggling are given with a touch of realism, since two actors do really tug at one another manfully. The girl sitting atop the piano plays galloping horses with two wooden sticks. Rain is a simple matter to produce. Dried peas are simply poured through a bit of pipe in front of and close to the microphone. There are any number of bells shown in Fig. 3 used in the productions. Fig. 4 shows the method employed to create the sensations of a forest fire, while Fig. 5 shows complicated movements and microphone settings necessary for the simple business of leading one character in or out of a room.

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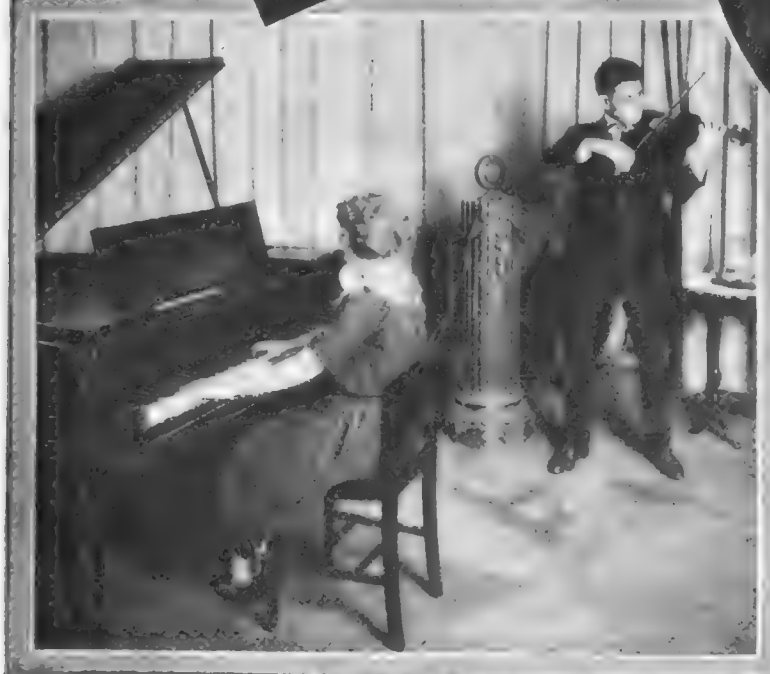
Philadelphia's Radio Entertainers

All radio fans living in the eastern part of the United States are acquainted with the call letters WOO, which is the sign of the Wanamaker store in Philadelphia. At the left is given a good photograph of the business end of that station as it appears while one of their programs is being put on the air. The control board seems unimposing when the strength and range of the signals emanating from it are considered. However, the half-kilowatt which it controls manages to create quite a splash in the ether, in spite of the simplicity of the layout. Such a splash does it initiate, in fact, that amateurs and broadcast listeners of France, England and northern Canada have reported picking up programs from this Philadelphia station time after time with extreme regularity.

Not the least of the features coming from WOO are the organ recitals. Aside from the fact that world-known artists are employed is the advantage of the organ itself. In addition to being one of the largest—if not the largest—it was built with the most exquisite care, which accounts for its marvelous tone quality. The photo above shows Miss Mary Vogt, one of the regular artists seated at the manual of the organ. Note the five key-boards.

The programs broadcast from WOO are excellent, partly on account of the fact that Robert E. Golden has a hand in the arrangement of them. The above photograph shows Mr. Golden playing a violin solo for the listeners to his station. When he is not engaged in playing for the studio he leads the Wanamaker Crystal Tea Room Orchestra.

Here (at the right) is shown another of Philadelphia's radio entertainers. It is the Strawbridge and Clothier's station WFI. The studio of the station is shown in the illustration. One of the most notable facts concerning this station is that it was constructed completely and entirely in the store where it is installed.

—Samuel Lowenstein, Reporter No. 4018

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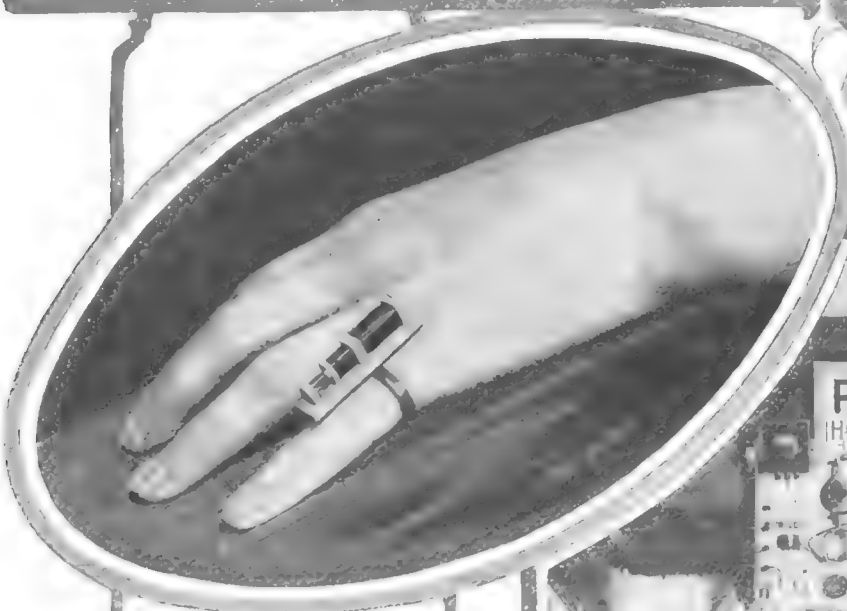
The Month's Radio Novelties

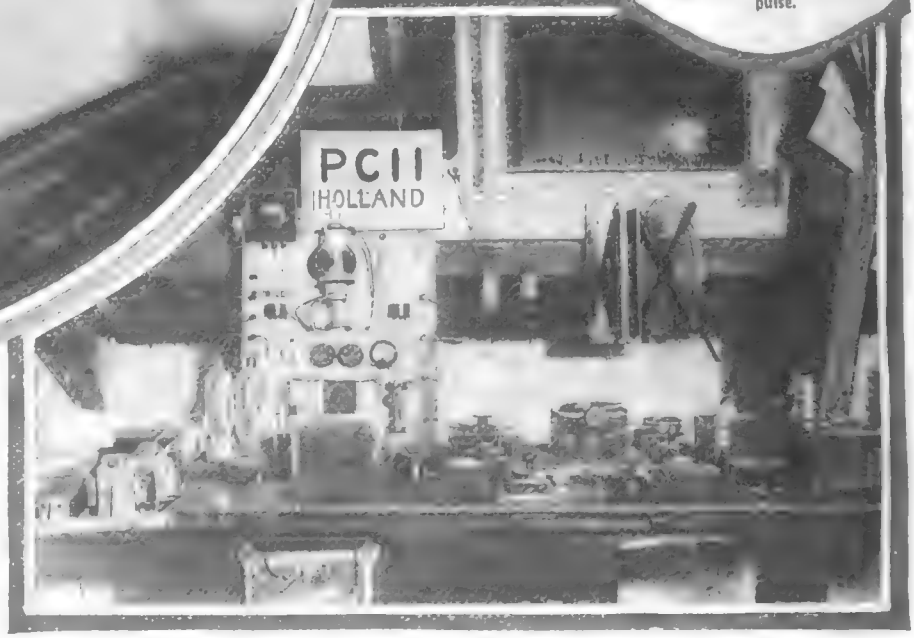
A Radio Kiss—Record Making Station.

Another use has been found for the new, ultra sensitive Thomas microphone. It is to transmit the palpitations of the lovers' kiss. Above is shown the technical director of station KDKA attaching apparatus to the wrist of a young lady for demonstration.

Not only have the actual heart-throbs of lovers (see above) been broadcast to the cold, cruel world sitting at their receivers scouring the country for DX, but also the physicians have sought this universal method of telling the world how little Lady Nicotine does her stuff to tender, pure, defenseless little heart. They have shown (or rather made audible) the little vampire doing most terrible things to the pulse.



We have had honeycomb headdress, telephone tiaras, peanut tube pendants and now come the jewelers and novelty mongers, still laying siege to our recalcitrant pennies through the medium of the radio emblems. Look at the illustration above and leave the extra quarters on the shelf by the gas-meter for the little woman or the best girl is sure to want the loose coupler ring. The ring itself is bona fide and will tune to a broad band of waves, permanent, marcel and otherwise.



About a month ago several Chicago city editors cocked their heads and called a dubious reporter sending him out to the suburbs. It was a strange address to the reporter so sent. No movie actresses lived there and there were no convenient culverts about where dead bodies could be hidden. The address was a radio shack where a message from Holland had been received. Above is shown the station where the message started, sending it across the Atlantic in one jump. It is a record.

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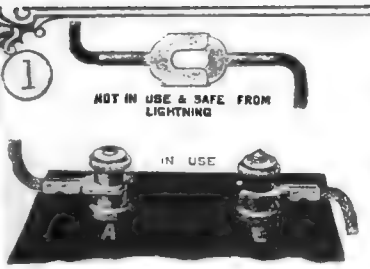
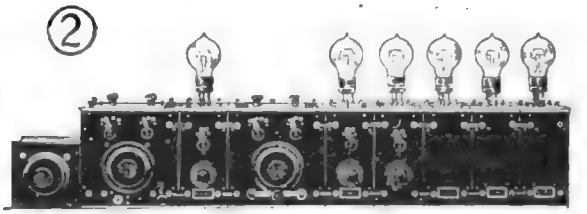
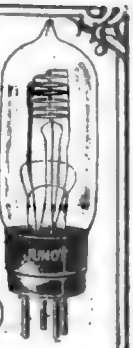
Foreign Ideas in Radio Apparatus

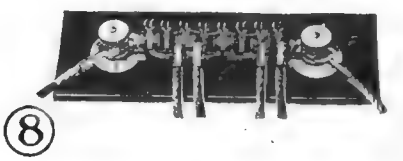
Some Typical European Radio Manufacturer's Products



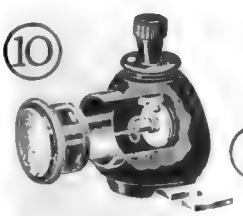


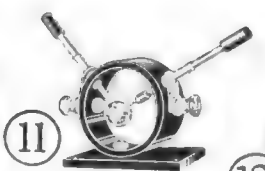


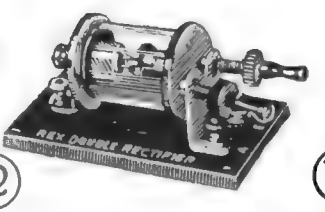
One of the most novel ideas adapted by a European manufacturer is shown at 1. The antenna and ground leads to the set are in the form of clips that may be locked together, grounding the antenna, when the set is not in use. Most French manufacturers build their Super-Heterodynes in units, as shown at 2. The oscillator is in a unit by itself as shown, and stands to one side of the regular set. For making a quick connection without the use of solder, we have a very novel idea illustrated at 3. The clip is made of spring metal and one connection is slipped through two holes, the other connection being passed through the crotch of the U formed by the spring metal. The spring clamps both connections tightly. At 4 we have a French spare filament vacuum tube. It might be well to note that all the vacuum tubes manufactured in the early days of radio had this spare filament characteristic. It was a great factor in saving since the life of the tube was practically doubled. When the first filament burned out it was only necessary to connect the second one in the circuit. We wonder why the French and English place the bulbs on top of the cabinet unprotected as is the case with the Super-Heterodyne shown above.

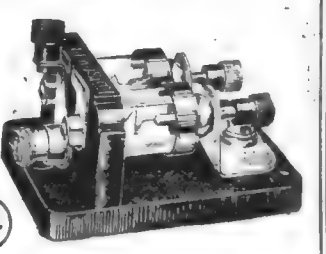


It seems that the Europeans are much stronger for unsoldered connections than are the Americans. In the above illustrations (from 5 to 9) we see a large number of connecting devices which are evident in every radio display throughout England and Continental countries. Also they are much more addicted to lugs than the American manufacturer. Representative adjuncts of this type are shown at 9. Possibly one reason for this fact is the comparatively exorbitant prices of radio apparatus as compared with the income of the experimenter in those countries. In experiments the same pieces must be used over and over again. Fig. 8 shows a multiphone-tip connection block.

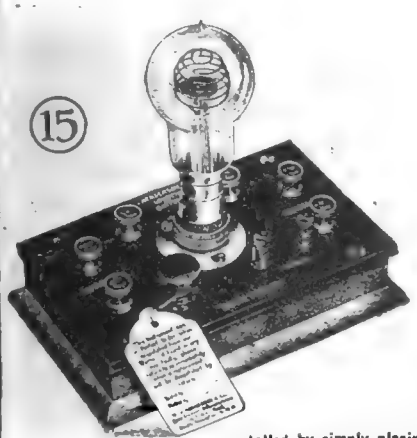


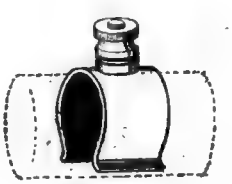


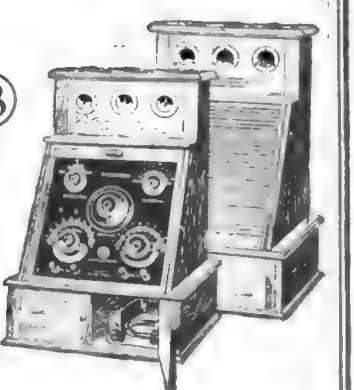




The popularity of crystal detectors may be judged by the number and variety of their design. Every radio shop will come near having dozens of them scattered about the shelves. Seemingly many more are sold there than here. The above illustrations from 10 to 14 show only a few of the varieties available. Note that in nearly all cases many crystals and cat-whiskers are available on the same stand.







At 15 we have an instrument that the American manufacturers would do well to copy. It is called the Neon Unit and is used for making all sorts of radio measurements. With the assistance of outside shunts, inductances and capacities one may measure the capacity and natural period of the antenna, check the emitted wave of a station, determine the value of a coil or condenser—in fact, it is about the most valuable measuring instrument one may have about a radio station. It is enjoying great popularity with the European amateurs, at present. At 16 is a ground clamp which is installed by simply placing it over a pipe or rod. At 17 is a change-over switch with exceptionally low capacity. It is an exceptionally handy instrument for changing a double to single circuit tuner for quick shift. At 18 is given a recent and novel form of receiver cabinet in which the roll-top desk idea is adapted to the instrument. The roll cover is exceptionally easy to operate and gives the instruments perfect protection while they are not in use. This is another European idea that the American manufacturers and designers would do well to copy. It is our guess that it would be immediately accepted.

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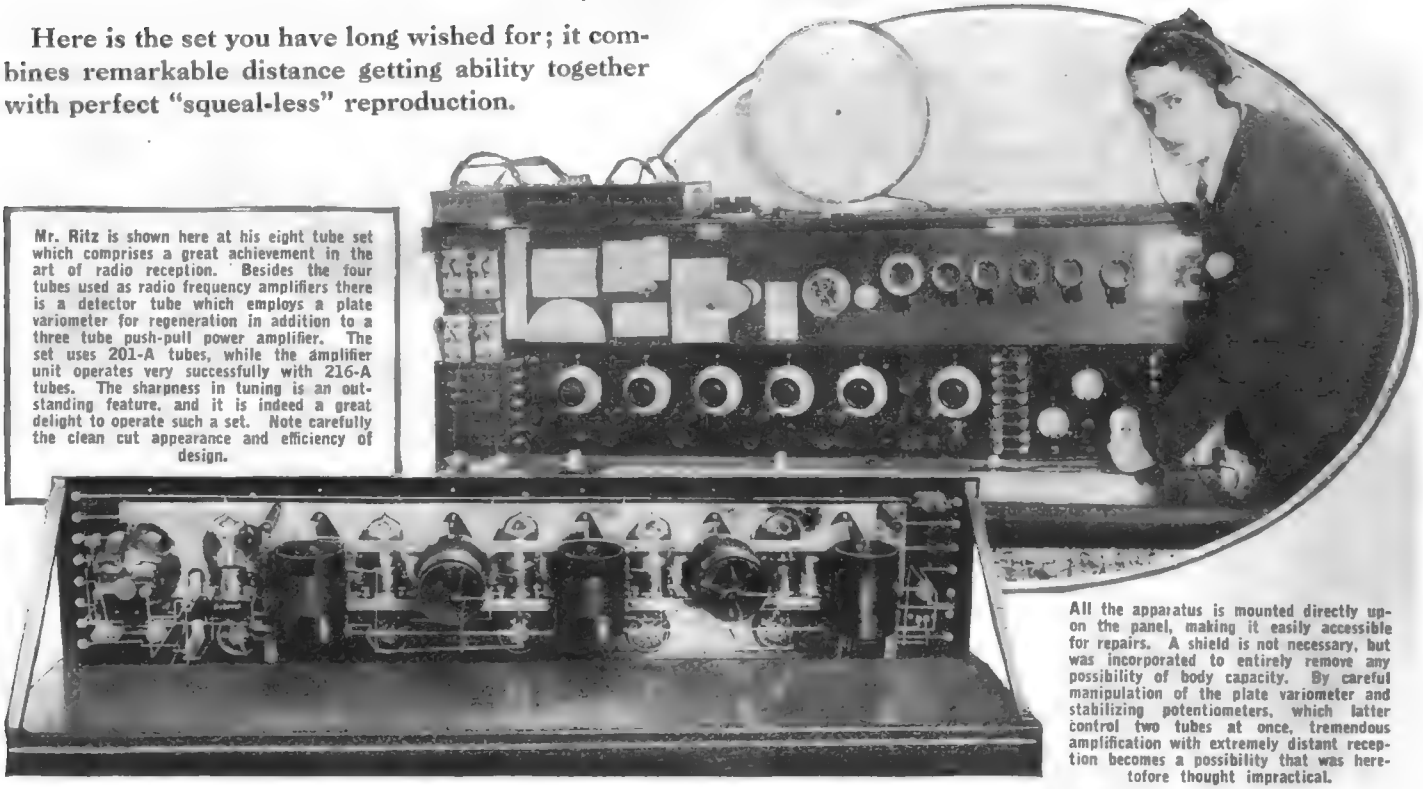
The Ritz Super-Neutrodyne

By LEON L. ADELMAN

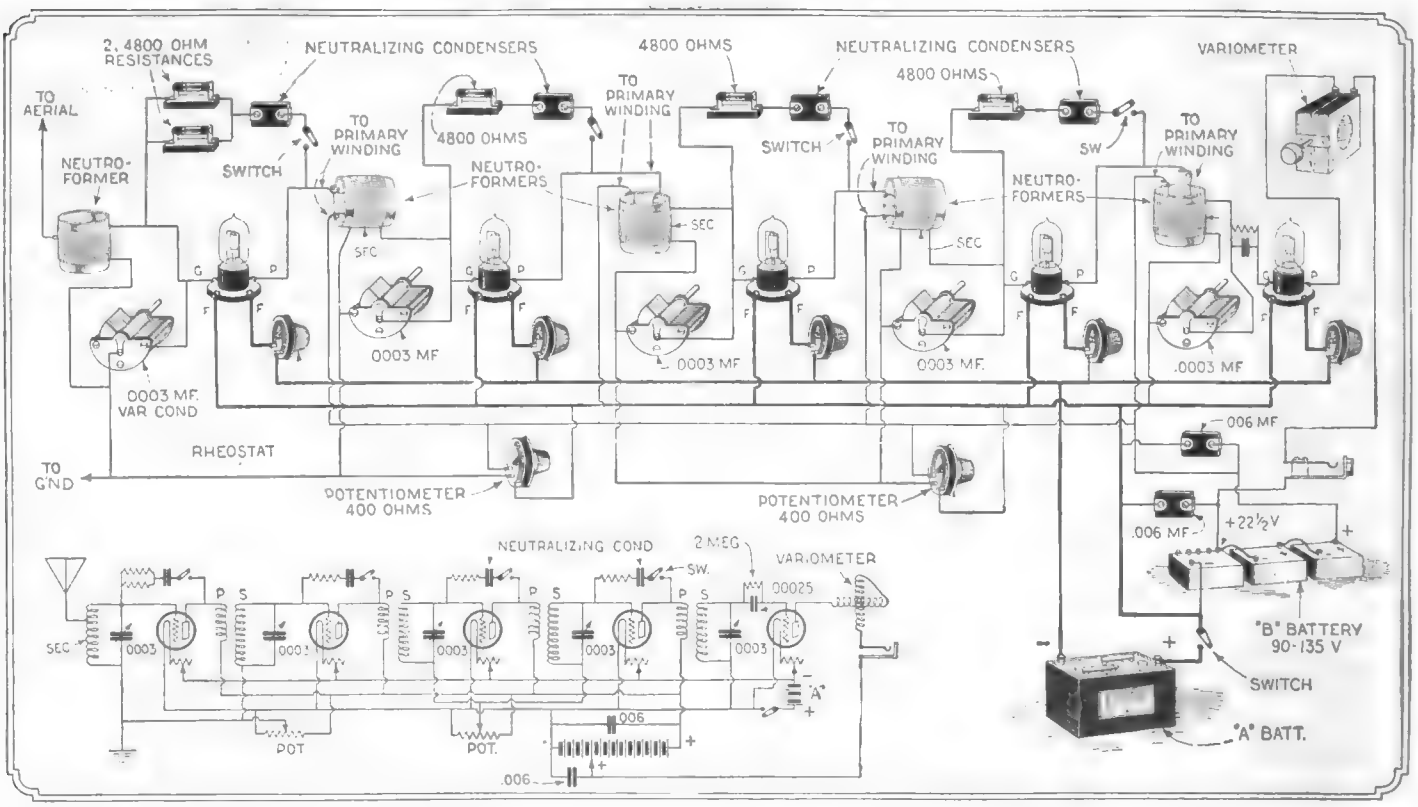
Here is the set you have long wished for; it combines remarkable distance getting ability together with perfect "squeal-less" reproduction.



Mr. Ritz is shown here at his eight tube set which comprises a great achievement in the art of radio reception. Besides the four tubes used as radio frequency amplifiers there is a detector tube which employs a plate variometer for regeneration in addition to a three tube push-pull power amplifier. The set uses 201-A tubes, while the amplifier unit operates very successfully with 216-A tubes. The sharpness in tuning is an outstanding feature, and it is indeed a great delight to operate such a set. Note carefully the clean cut appearance and efficiency of design.

All the apparatus is mounted directly upon the panel, making it easily accessible for repairs. A shield is not necessary, but was incorporated to entirely remove any possibility of body capacity. By careful manipulation of the plate variometer and stabilizing potentiometers, which latter control two tubes at once, tremendous amplification with extremely distant reception becomes a possibility that was heretofore thought impractical.

AFTER eight months of hard and patient labor, Charles Caesar Ritz, prominent New York business man, has finally solved the problem of multi-staged, tuned, neutralized, radio-frequency amplification. His four-stage radio-frequency unit employs, practically, the Ferrand method of neutralization, adding special resistors and stabilizing controls. By a unique arrangement, the outfit can be used as a straight tuned radio-frequency set. There are four miniature single-pole switches placed in series with the neutralizing resistances and neutrodons, or neutralizing condensers.



THE majority of the radio receivers today employ radio frequency amplification. None of them use more than two stages, this being due to the trouble arising from self-oscillation which results in squealing. Only by the greatest amount of elaborate experiments was Mr. Ritz able to successfully use four stages. The set which he has evolved is very sharp in tuning and causes very little noise. Some remarkably distant stations have been heard, and those on the Pacific Coast come in with regularity as often as five nights a week. When the set is used as a straight tuned radio-frequency receiver, very good results are obtained with a resultant slight diminution in volume. There is no appreciable difference in selectivity when used this way, although static is somewhat bothersome. The plate variometer readily offsets this, however, and causes sufficient regeneration of the incoming signal, so as to render the static negligible. All powerful local stations can be easily tuned out by a mere slight turn of any one dial. Instead of a three tube push-pull amplifier, a two stage audio-frequency amplifier is desirable, as the signal strength is more than necessary.

(RADIO DEPARTMENT CONTINUED ON PAGE 522.)

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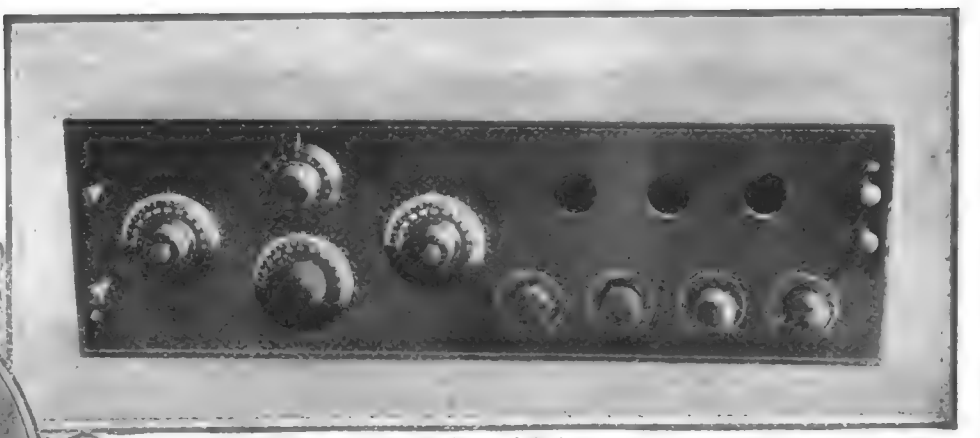
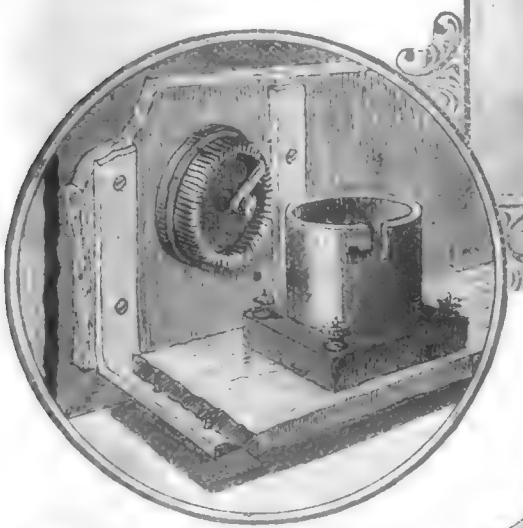
A Selective 3 Tube Receiver

By W. L. PEARCE

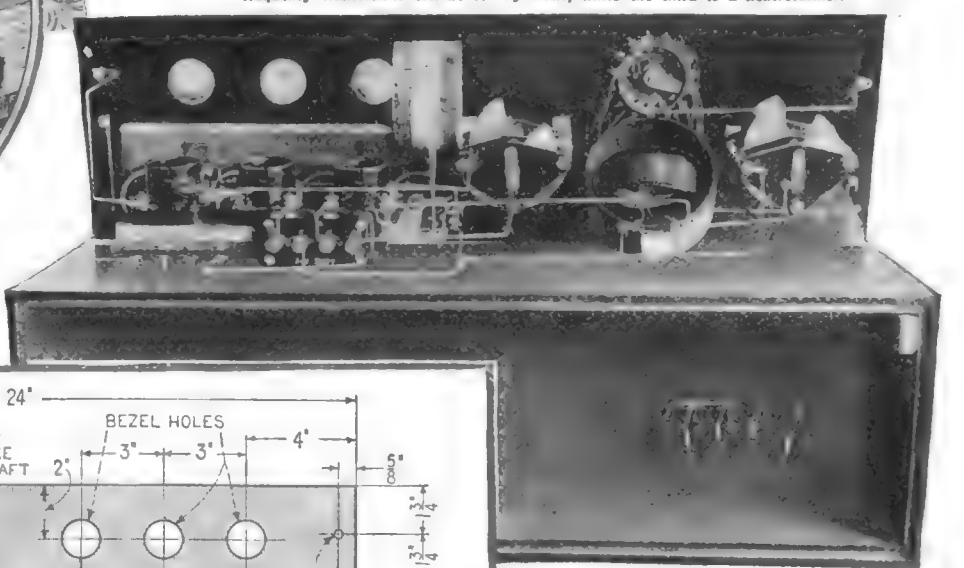
Everyone is desirous of learning how best to employ three tubes in a receiving circuit. This hook-up, which consists of one stage tuned radio-frequency, one stage untuned radio-frequency amplification and detector, constitutes the best arrangement for a simple DX or long distance set. Photograph at the right shows the complete set, contained in a twenty-four by seven inch cabinet. The sketch immediately below shows how the tube sockets are supported on the sub-rack directly behind the panel.

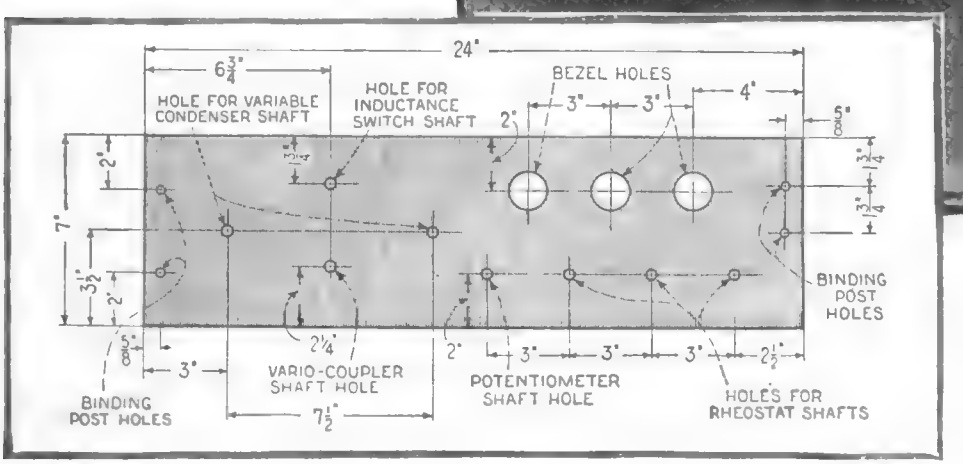


A glance behind the panel shows the layout of the instruments. A vario-coupler is used as the first radio-frequency transformer, and advantage is taken of the variable coupling. The second radio-frequency transformer can be of any make, while the third is a neutroformer.

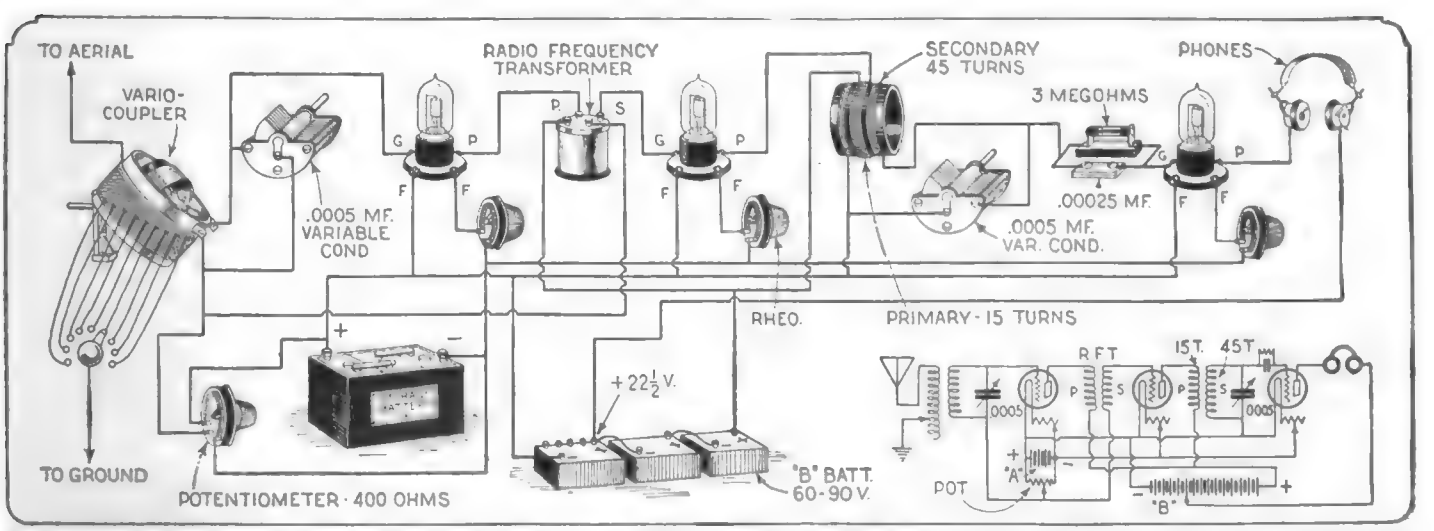


The panel lay-out calls for three bezel holes through which the tubes can readily be seen. The better panels are of bakelite, hard rubber, formica or glass.





The diagram shows how the set is hooked up. A special arrangement for the battery terminal connections is shown in the photograph. Phone tips are soldered to short flexible leads, which are attached to the back of the cabinet, with binding posts. The phone tips are inserted in their respective jacks, which are racked on a small bakelite strip immediately behind the sockets. This receiver, due to the simplicity of its construction, does not cost very much to build, and offers a bountiful return in satisfactory operation. U. V.-199 tubes can be used instead of the ordinary 201-A's.



When tuning the set it is necessary to move both condensers at the same time, and this allows for direct calibration. Although a three megohm grid leak is shown in the diagram, a variable one is usually preferable. The primary inductance is varied by a 15 point switch, and very fine tuning is accomplished. In its stead, however, a twenty-three plate variable condenser can satisfactorily be used. This set has received stations up to a distance of twenty-five hundred miles. Address the writer for any further data.

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Radio Oracle

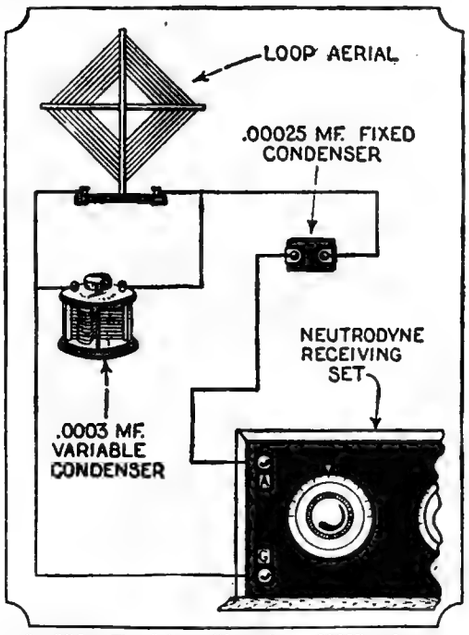
In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c. is made for all questions where a personal answer is desired.

LOOP WITH NEUTRODYNE

(286) Morris V. Gordon, El Dorado, Arkansas, says he has a Neutrodyne receiver and would very much like to use it with a loop which he has recently purchased. He asks:

Q. 1. Will you kindly show diagram?

A. 1. A loop may be very successfully used with the Neutrodyne receiver and distances up to 1500 miles can be easily obtained. Although it is advisable to disconnect entirely the first radio frequency transformer and connect the loop directly to the first tube, this can be avoided by interposing a small fixed condenser in series with the antenna post as is shown in the diagram.



Q. 286. The interposition of a .00025 mf. condenser facilitates sharp tuning and offsets the necessity of changing the interior wiring of the Neutrodyne set for use with loop aerial.

NEUTRODYNE HINTS

(287) Joseph F. Russo, New York City, N. Y., says he has assembled a Neutrodyne receiver using parts of a well known make and has heard other receivers, but his arouses his ire in causing him such exasperation as to give up in despair. He asks:

Q. 1. Can you suggest any help?

A. 1. The Neutrodyne, without doubt, is the real distance getter and when once adjusted, will cause no further trouble. The first place in which to look after trouble is the aerial circuit. Having ascertained that the primary winding is not broken, that all leads are carefully soldered, with a minimum of wire between terminals, the primary windings of the radio and audio frequency transformers are tested by the use of a single dry cell and a pair of phones. Similarly, all secondary windings are tested, and then the fixed condensers. These in many cases, especially when they are shunted across the high voltage terminals, will break down and make a short circuit, doing material damage.

Blow all dust from off the plates of the variable condensers and tighten the bearings, having carefully centered the movable plates. This is vital, as the loose bearing contact is a very high resistance connection in a R.F. circuit. Under no circumstances should the bearings become so loose that it is possible to actually spin the dials around.

Many times the Neutroformers or R. F. amplifying transformers are too close together. This causes interaction with maximum tendency for making the R. F. tubes oscillate which of course is undesirable. At 54.7 degrees from the vertical the coils should be at least 1½ inches apart, and no more than 5 inches, as this increases the length of the leads materially.

Very often, too, it happens that a poorly constructed tube is responsible for the inferior results obtained with the Neutrodyne. A poor detector tube is the worst of all the poor tubes on any set, let alone the Neutrodyne.

If after trying vainly to neutralize a set, a .006 by-pass condenser is placed across the secondary of the audio frequency transformer, and a 200 ohm potentiometer placed in series with the plate supply of the "B" battery, the negative pole of both "A" and "B" batteries grounded, the set will in the majority of cases be completely neutralized. In this way 135 volts instead of the usual 90 can satisfactorily be used on the amplifier tubes with the resultant increase in volume.

NECESSITY OF GRID LEAK

(288) William J. Williams, Omaha, Nebraska, says he has tried many circuits and has found that in some he could entirely eliminate the grid leak without undue loss in volume of an incoming signal.

Q. 1. Can you explain this?

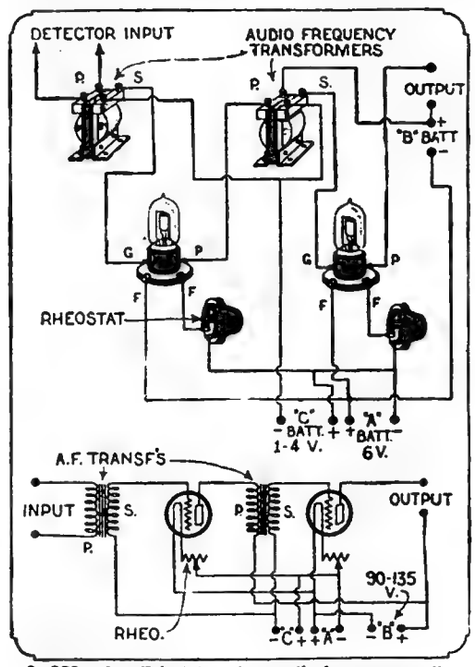
A. 1. While it is true that many circuits will work satisfactorily without a grid leak, yet there are many more that will work to better advantage with one. During the process of reception, negative charges of electricity pile up upon the grid due to the action of the grid condenser. If a means for returning these superfluous and excessive negative charges to the filament is used, through the employment of a suitable grid leak, signals will be reproduced with fidelity. However, if a grid leak has too high a resistance, these charges escape too slowly and naturally the incoming signal becomes distorted. If the grid-leak resistance is too low, the incoming signal is short circuited and a large amount of the energy is wasted. For the ordinary detector tube, 1 to 3 megohms should be experimented with, in order to find a suitable value for the tube. As a detector tube is generally a soft tube or in other words has a gaseous content, it sometimes is not necessary to employ a grid leak. This is because the negative charges are carried away by the ionized hot gases within the tube. Again in the employment of a hard tube for detection, the gas content being relatively much lower, the negative charges, if no grid leak is employed, actually become sufficient to paralyze the rectifying action of a tube and no signals will be heard. In this connection especially when a high voltage "B" battery is used, it is best to use a grid leak.

AUDIO FREQUENCY AMPLIFIER

(289) Frank Tarleau, Frankfort, New York, asks:

Q. 1. Kindly give me full particulars for making a two stage audio frequency amplifier and what is the advantage of using high ratio transformers?

A. 1. The hook-up given below depicts clearly how to connect the various instruments in a two stage audio frequency amplifier unit. The "C" battery is introduced in the grid circuit and its function is to lessen the plate current slightly, thus giving clearer reproduction. It is absolutely unnecessary to use high ratio transformers inasmuch as distortion begins to occur in



Q. 289. An efficient two stage audio frequency amplifier whose first name is "Clarity" is shown here.

transformers having a higher ratio than 1 to 1. The average all around transformer which is best adapted for use in an audio frequency amplifier is one having a 3½ to 1 ratio.

By carefully adjusting the grid biasing battery, amplification without distortion can be accomplished when using higher ratio transformers, although this is not advisable inasmuch as a "C" battery will tend to cut down the volume.

TUBE BASE CEMENT

(290) Alexander J. Wilcox, Hollywood, Calif., says that his tube seems to have become loose from its base. He asks:

Q. 1. Can you please tell me how to fasten it again?

A. 1. A ready repair for such a state of affairs would be to melt ordinary sealing wax around the top of the base and let it become hardened. Of course, if you desire a more finished appearance, ordinary marble dust mixed with shellac will serve as a very durable cement for your purpose. Be sure that you do not twist the tube around so as to short-circuit the connections in the base.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We like articles on new single tube receptors. We will pay good prices for your ideas. —Editor.

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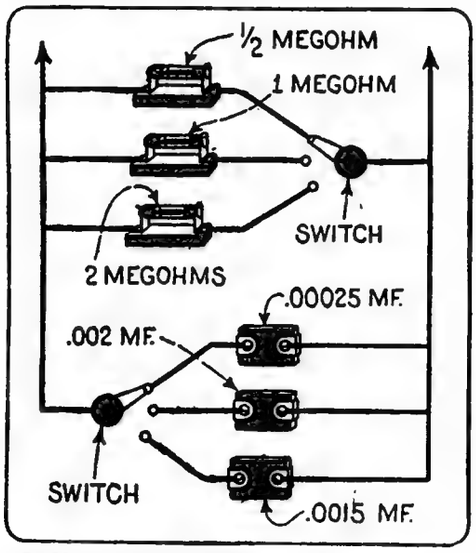
STABILIZING METHODS

(291) H. K. Wilder, East Pittsburgh, Pa., asks:

Q. 1. Can you kindly tell me of several different ways in which I can improve the tonal quality of my three tube radio set?



Q. 291. By employing various values of grid condensers and leaks the best size for the different stages in the life of a vacuum tube can be readily ascertained.

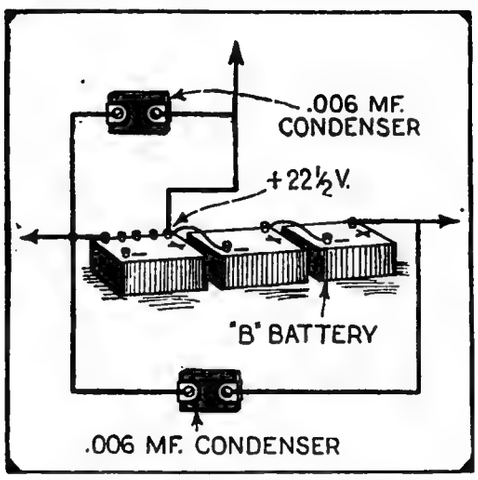
A. 1. The quality of reproduction can be greatly improved by the addition of by-pass condensers, stabilizing potentiometers and a variable grid leak and condenser. The diagrams depicted show clearly what changes to make in your receiving set. Always be sure that only a minimum of moisture is able to get into the receiving set, because moisture not only lowers the efficiency of the apparatus employed, but tends to accelerate corrosion of contacts and short-circuit all the insulating material.

CIRCUIT EMPLOYING A LOUD SPEAKER

(292) John Moore, Summerville, N. J., says he has built a set using two tubes and a crystal and fails to get results on his loud speaker with it, although he hears many stations distinctly with the phones. He asks:

Q. 1. Can you help me?

A. 1. According to your diagram, the circuit which you employ is a two stage radio frequency amplifier and crystal detector circuit. As is well known, radio frequency amplification affords relatively no marked increase in volume, but does tend to give a circuit selectivity to a much greater degree than could otherwise be obtained. Would very much suggest that you change your circuit to one stage radio frequency amplification, crystal detector and one stage audio frequency. The same "B" battery can be used for the operation of both tubes.



Q. 291. The "B" battery should be shunted with small fixed condensers which by-pass the radio frequency currents.

NEUTROFORMER DATA

(293) James Rubbenrout, Atlanta, Ga., says that as a last resort he is writing to us for all information concerning data pertaining to the winding of neutroformer coils. It seems that all those parties whom he has asked disagree as to the number of turns that should be employed in the primary winding. He asks:

Q. 1. I want reception from 200 to 600 meters, that is to cover all broadcasting wave-lengths. How can I accomplish this?

A. 1. For the most efficient neutroformer a self-supporting coil, wound with a large size wire such as No. 12, silver plated to reduce skin effect and which winding is staggered, similar to the winding of a low loss coil, should be used. However, as there are too many technicalities to be overcome in the construction of such a coil, the nearest approximation to it can be obtained by using a secondary tube which measures three inches in diameter and whose winding will consist of 65 turns of No. 22 double cotton covered pure copper wire. The primary will be 2¾ inches in diameter and should be wound at one end with 15 turns of No. 18 double cotton covered wire. Both tubes should be 3½ inches long and of a non-porous, non-hygroscopic, non-absorptive insulating material such as bakelite or a very good grade of formica. If at all necessary, the coil should be impregnated with collodion. The secondary has a tap taken off at the 15th turn. This tap connects with the neutralizing condenser.

CRYSTALS AND CONTACTS

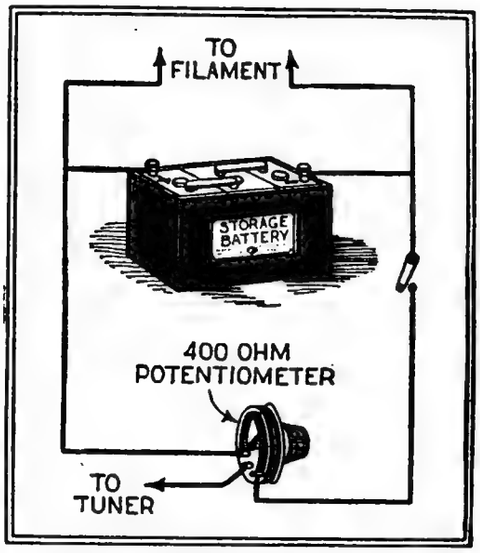
(294) Willis C. Webb, Muskegon, Mich., asks:

Q. 1. Can you give me some information on the use of galena and silicon as rectifying elements in a crystal detector? Must the surface of the crystal be smooth?

A. 1. The most sensitive crystal of those mentioned to use in a receiving set is galena, which works best with a very light phosphor bronze or gold cat whisker. Silicon may also be used, but we advise you to procure a piece of fused silicon, and use it with a brass point contact, using quite heavy pressure. It really makes very little difference whether the surface of the crystal be smooth or not, but galena generally comes in a cubic crystalline form with very smooth faces.

CONTROLLING OSCILLATION

(295) W. P. Auchey, Pasadena, Calif., says that his three coil honeycomb set oscillates very freely causing unearthly squeals. He asks:



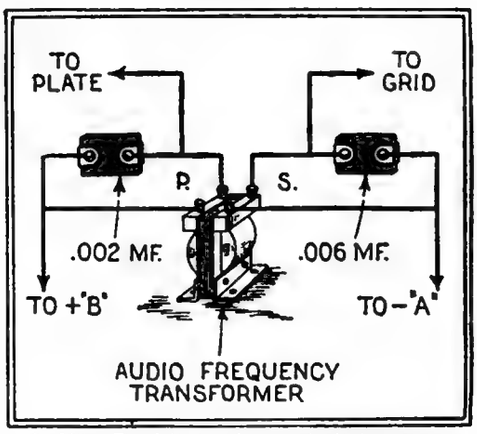
Q. 291. If a potentiometer is connected across the "A" battery, much finer control in tuning can be had.

Q. 1. How can I remedy this?

A. 1. First cut down your "B" battery voltage, if higher than the normal rating required by both detector and amplifier tubes. Turn the filaments down if too brightly lighted. If you have a filament current ammeter, check up to see that you are not overloading your tubes.

Next, loosen tickler feed-back coupling until the set is just on the verge of breaking into oscillation. If squealing still occurs, change value of grid leak.

A .00025 mf. fixed grid condenser can be used for practically all tubes and when shunted with a leak of from ¼ to 2 megohms resistance will give the best results. It may be that the honeycomb coil used as the tickler is too large, having too much inductance. Try a smaller tickler coil.



Q. 291. The A.F. transformers should have by-pass R.F. condensers across their terminals. The use of the lower ratio transformers is advised.

A SENSATIONAL RADIO INVENTION

The crystal now replaces the vacuum tube. A full description of this startling achievement is featured in the September issue of RADIO NEWS now on all newsstands.

Mr. O. V. Lossev, a young Russian engineer, has discovered a way to make a crystal oscillate. Not only is it possible to receive over long distances with a crystal, but it is also possible to send or transmit with this new CRYSTODYNE PRINCIPLE. The new CRYSTODYNE does everything that the vacuum tube does. One of the greatest discoveries of radio in the past twenty years. Do not fail to read all about it.

INTERESTING ARTICLES APPEARING IN SEPTEMBER RADIO NEWS

The Crystodyne Principle.
A. C. Applied to Receiving Sets. By Florian J. Fox.
Neutrodyne Receivers. By A. L. Groves.
Reflex Radio Receivers in Theory and Practice. By John Scott-Taggart.
The Use of Iron in Transformers. By Sir Oliver Lodge.
Six Tube Receiver of Advanced Design. By The Technical Staff.
More Solodyne Circuits. By A. D. Cowper.

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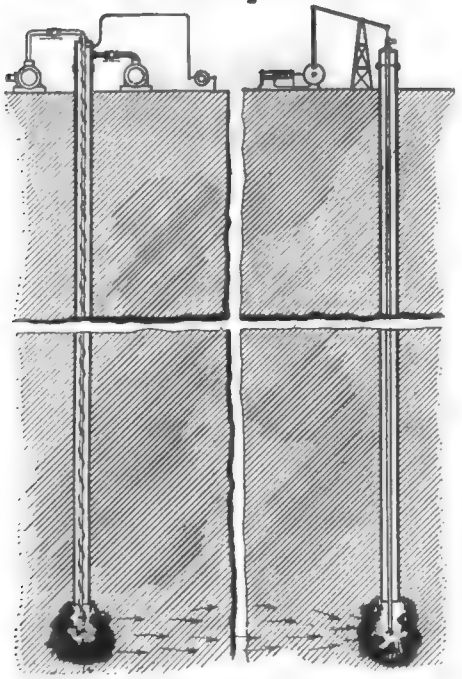
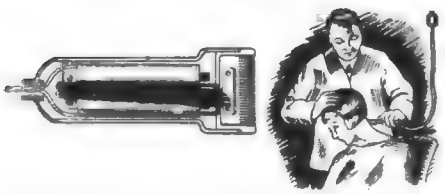
LATEST PATENTS

Oil Well Operation



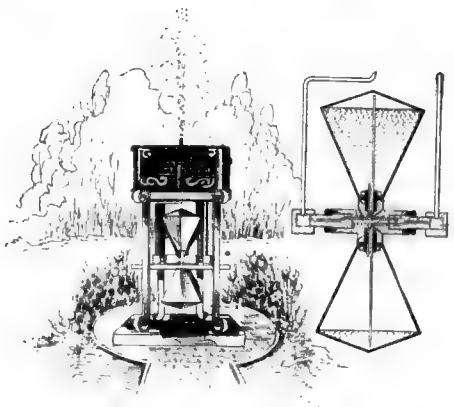
1,473,348, issued to Frank A. Howard. Air is pumped into a dry well casing. Thereafter, gas is pumped into the well to form a combustible mixture. This is ignited and the pressure of the gases force oil from the shale into surrounding dead wells, which oil is then pumped up.

Hair Clipper



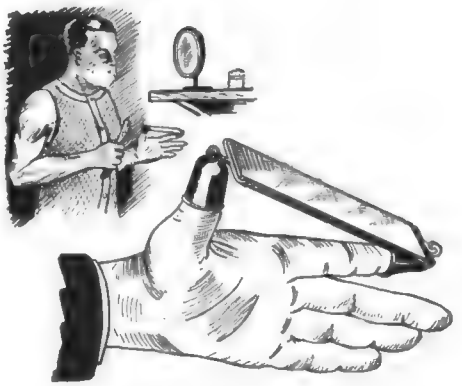
1,471,536, issued to Leo J. Wahl. The clipper indicated above is of the vibrating type and operates on alternating current circuits. The armature moves toward and away from the axes of the electro-magnetic coils. One of the clipper blades is attached to the moving armature, the other is stationary.

Mechanical Fountain



1,490,833, issued to William F. Kling. Two cone shape tanks are mounted on an axle fitted with pipes as indicated above. When the tanks are in the position shown, water will flow into the lower tank, decrease the air space and cause the fountain to bubble. When the fountain stops the tanks are reversed and operation begins anew.

Razor Strop



1,485,350, issued to John W. Shepard. This razor strop is supported by two retaining cuplike members, one engaged by the finger and another by the thumb and held in this position during the stropping operation.

WANTED

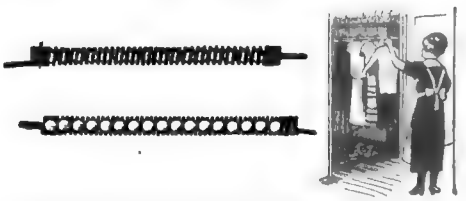
ARTICLES pertaining to automobiles such as handy kinks, roadside repairs and anything of interest to the man who drives a car. $50.00 in prizes every month are offered by MOTOR CAMPER AND TOURIST for such articles. Get a copy at your newsstand and see what is wanted. If your newsdealer cannot supply you send for free sample copy to:

MOTOR CAMPER & TOURIST
53 Park Place,
New York City.

Leveling Device

1,488,749, issued to Jacob Franz. The system described in this invention is not new, this leveling device having been used years ago in China and other countries. The inventor improves upon the idea by adding a valve to the top of each of the glass tubes. A flexible tube filled with a liquid completes the arrangement.

Moth Ball Holder

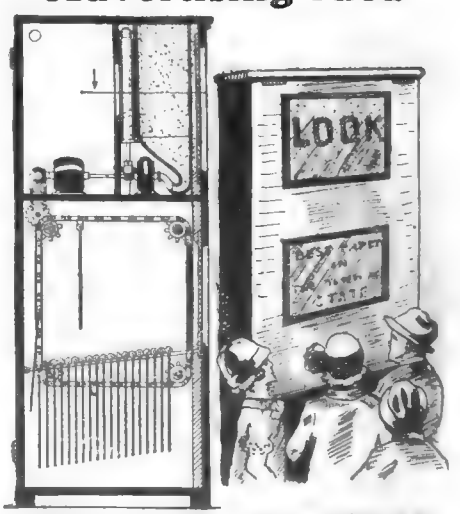


1,484,510, issued to Robert J. Lewers. A long coiled spring wire forming a clothes hanger, contains moth balls. This may be used for hanging garments upon or it may be placed along the seams of the door where its action is very effective. It can easily be replenished.

Comb Combination

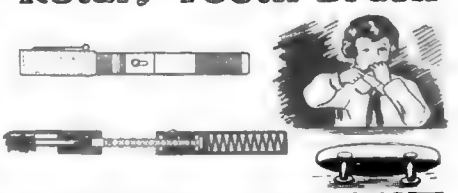
1,497,524, issued to Leo McSweeney and Arthur Wilson. The comb in this device is slipped into the handle of the brush. The whole is then held in place in a hat and is available for instant use. The holder is designed for both soft and hard hats.

Advertising Idea



1,475,540, issued to Henry M. Cheek. A blower in the bottom of the upper half of the cabinet causes confetti or bran to fly around and form letters due to the fact that the cabinet is air-tight except for the cut-outs of the letters, which are covered with gauze.

Rotary Tooth Brush



1,481,891, issued to James R. Cruikshank. The rotary tooth brush illustrated above is made in the form of a fountain pen. By working the handle back and forth the brush rotates rapidly and in this manner cleanses the teeth thoroughly.

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Scientific Humor

PARADOXICAL

PROFESSOR: "Can you cite an instance where heat produces cold?"

FLIP STUDENT: "When the critics roast a play it becomes a frost."—*Jas. J. O'Connell.*

WE'RE DUSTLESS

"That professor has an odd name for the money he makes from lecturing on astronomy."

"What does he call it?"

"Star dust."—*Les Van Every.*

THE LOST CHORD

TEACHER: "Name an important bodily organ and part of it."

LOTTIE: "The throat organ and its windpipe."—*Herbert F. Bechtold.*

WHAT DID TENNES SEE?

They were talking of the marvels of wireless telephony and a conversation between Rome and London was mentioned. "Ah that's nothing," replied Braggo, "I know a man who blew a bugle in Pittsburg and went to Long Island and saw the Sound."—*H. Rowe, Jr.*

BUGHOUSE

"Ma, does a bear pass through the larva stage too?"

"Nonsense, child."

"But what's a bugbear?"—*Herbert F. Bechtold.*

FIRED

"Our hired man is like static electricity."

"How is that?"

"He is always at rest until he is discharged. —*Reporter No.* 6042.

WHERE ENDS MEET

"My Math. Prof. is surely absent-minded. Why, I've seen him time and again trying to strike a match on the wrong end."

"Is that how he wore all his hair off?"—*Campbell Scarth.*

A "COLT" IN THE CHEST

A young Dutch singer had an engagement with a radio broadcasting station. The night of the program found him slightly hoarse, and his Dutch manager undertook to explain his absence to the radio public thus: "Ladees and chentlemen Mr. Blank vishes me to tell you that this efening he is a little 'hoarse'". Fearing the people would not understand he continued:—"Vat I meant to say is that Mr. Blank is a little horse, he has a little colt you see."—*Raymond Fullerton.*

NOT ACCORDING TO DARWIN

"My ancestors came over in the Mayflower."

"That's nothing, my father descended from an airplane."—*H. B. Dahl.*

RIGHT

What musical instrument has been produced by Radio?—The Lyre.—*E. O. McCoy.*

First Prize $3.00

SHADES OF ARCHIMEDES!

PHYSICS TEACHER: "Now James, what did Archimedes say when he found his bath was overflowing?"

JAMES: "Eureka, I have found it."

TEACHER: "And what did he find?"

JAMES: "Er——he must have found out how to stop the water."—*James Mersand.*

HE'LL BE DEAD SOON

LONG-WINDED PROF. (to class in astronomy):—"Now, young men, as we take this trip through the ether which lies beyond the atmosphere of our earth, I shall show you many wonders of interstellar space—"

(Follows, a long period, broken at length by the snoring of a student on the back seat).

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to "tie" for the prize, then the sum of three dollars in cash will be paid to each one.

LONG-WINDED PROF.: "What is the matter with the youth? Has he gone asleep or is he ill?"

ATTENTIVE STUDE: "Don't know, Prof. He was all right before we entered the ether, but we've stayed so long I'm afraid he's chloroformed!"—*John R. Malloy, Reporter No. 12257.*

JUST DUMB

ASTRONOMY STUDENT: "That star above us is ten times as large as the earth."

NEW STUDENT: "Then why doesn't it keep the rain off the earth?"—*H. B. Dahl.*

HENS DON'T LAY EGG-PLANTS EITHER

LADY: "Why didn't you plant those bulbs like I told you to?"

RASTUS: "De sockets was missin', mam.''—*Herbert F. Bechtold.*

MARATHON GARAGE

PESSIMIST: "Now it's death by carbon monoxide."

HISTORIAN: "Probably, that famous Greek runner died of exhaust, you know.—*Herbert F. Bechtold.*

THE PHONE "TOLLED"

VOICE ON THE WIRE: "Do you mind holding the wire a minute?"

OTHER VOICE: "Certainly not. What I object to is holding the receiver."—*Jas J. O'Connell.*

SHE WAS A CHICKEN

SHE: "What is home without mother?"

HE: "An incubator, I suppose."—*Ned Guffey, Reporter No. 6042.*

THE RAINBOW RACE

The negro is born black, therefore he is not colored. Being human he sometimes feels blue, becomes green with envy or flies into a purple rage and sees red. Even in the pink of condition he may get white with fear and show a yellow streak.—*Joseph M. Straughan.*

UNDAMPED IN THE MOUNTAINS

RADIO FANS "Now that they are broadcasting the breakers on the shore, what kind of waves would you say we were hearing anyway?"

RADIO NUT: "Well, I suppose they ought to be 'damp' ones, don't you think?"—*Winthrop M. Leeds, Reporter No. 6625.*

ZOO LOGICAL

Women make monkeys of men.—*H. B. Dahl.*

THEN SHE GOT DAD'S FOOT

DADDY (winding up a stern rebuke): Now do you understand what I say?"

SMALL DAUGHTER (unimpressed): "Will you broadcast it again, Daddy? I haven't quite got your wavelength."—*T. B. Marsden, Jr.*

AND CHINA ON BAMBOO SPREADERS

JOE: "I just got the 'Lost Chord' over my 'stranded' aerial yesterday."

BLOW: "That's nothing. I got the bedtime stories over my bedspring aerial."—*Maurice Bergar.*

A GREEN LITTLE VERSE

A green little chemist on a fine summer day
Some chemicals mixed in a green little way.
The green little grasses now tenderly wave
O'er the green little chemist's green little grave.

—*H. B. Dahl.*

A MUD HEN

YOUNG LADY: "What do you think of mud as a beautifier?"

BEAUTY SPECIALIST: "Well, it hasn't done much for the turtle."

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THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

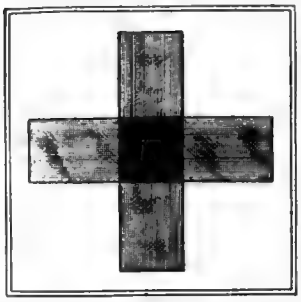
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

POLARIZED LIGHT

(1729) Rudolph P. Goodrich, Ferndale, New York, wants to know:

Q. 1. What is polarized light and how can I produce it?

A. 1. It is generally agreed that in light waves the vibrations are wholly at rightangles to the direction of the ray. In homeogeneous light or light of one wave-length the vibrations are conceded either to be in all planes of the circle,



Two crystals of tourmaline, having their axes perpendicular to each other, afford complete stoppage of light. Rotating one until both are parallel gradually permits light to filter through. A number of mystifying experiments can be made with polarized light.

some of the ellipse or in a single plane, but in white light, they are doubtless very complicated and irregular. If a plate of tourmaline crystal is placed in front of a beam of light, the beam will be passed through it and be affected so that the light emitted will consist of vibrations all taking place in some one direction perpendicular to the ray. A beam of light having this characteristic is said to be polarized. If another plate of translucent tourmaline is placed with its axis at rightangles to the first one and directly behind it, all light will be completely cut off. The first plate of tourmaline is called the polarizer, the second plate, the analyzer.

TRANSFERRING STENCILS

(1730) C. H. Chittenden, Ames, Iowa, would like to know:

Q. 1. How can I transfer fancy work stencils so that the design will be transferred red?

A. 1. Your question is rather difficult to answer offhand as we have no data concerning the same. However, you may try adding ordinary glue to a solution of warm water and soaking your stencil in that, after which it may be transferred. However, we will not guarantee results. We have tried to get information on this, but evidently there is none available.

FIXATION OF NITROGEN

(1731) Lawrence A. Stover, Vickery, Texas, asks:

Q. 1. Are the Haber or Bjornstrom processes used in this country and what information have you pertaining thereto?

A. 1. We believe that the Haber process is being used in the Muscle Shoals plant operated by the Government. As regards the Bjornstrom process, it is an entirely Norwegian undertaking and we do not believe that the process is undertaken in this country. You may write to De-Nemours DuPont & Co., Inc., 120 Broadway, New York City, for more particulars, also to the Superintendent of Documents, Government Printing Office Washington, D. C., and ask him for the latest publication on synthetic nitrates and fixation of nitrogen.

Power Without Wires

Is it possible to transmit power at a distance? It is! This is not a theory but a number of very interesting experiments over short distances are described in the September issue of PRACTICAL ELECTRICS by Mr. Esten Moen.

Anyone with existing apparatus is able to light small lamps over short distances. Every reader of SCIENCE & INVENTION will be interested in this article. Do not fail to get this important issue.

OTHER ARTICLES IN SEPTEMBER PRACTICAL ELECTRICS

French Million Volt Laboratory.
The Most Amazing Stuff on Earth. By Esten Moen.
Testing Metals with Roentgen Rays. By Dr. Franz Fuchs.
Floodlighting Madison Square Garden.
Solar Thermo-Electric Battery.

WEATHER INDICATOR

(1732) Howard E. Bowen, Baltimore, Md., wants to know:

Q. 1. How can I make a rain indicator to turn pink for rain and blue for fair weather?

A. 1. If you will mix gelatine with water and then pour the solution on the blotting paper, the same solution being first heated but not brought to a boil, and then after it is tacky enough, sprinkle your cobalt chloride upon the paper or blotter, you will obtain much better results than with any other method. You must be sure that you have cobalt chloride, however. There are very few other salts that will work.

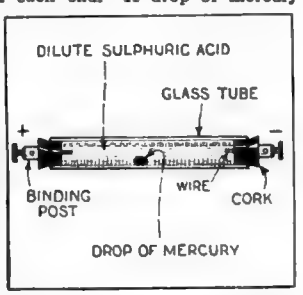
CAPILLARY ELECTROMETER

(1733) Jesse Hiller, Jersey City, New Jersey, asks:

Q. 1. What is the simplest means of determining the direction of an electric current?

A. 1. There are several positive methods of determining the direction of an electric current. One very good method is to put some dilute acid into a glass tube, corking it at the ends and inserting wire at each end. A drop of mercury

Dilute sulphuric acid and a drop of mercury placed in a glass tube composes a capillary electro-meter. This can be used to measure potentials as low as one volt. The higher the potential, the faster the mercury travels towards the negative pole.



is placed in the center and the current turned on. The mercury will travel towards the negative electrode. The reason for this is that the surface tension where the current passes from the acid to the mercury is increased and where it passes from the mercury to the acid is decreased, —hence the motion of the mercury. A number of interesting experiments can be tried with such a simple little piece of apparatus.

CHLORINE

(1734) Maxwell Strong, Albion, Mich., wants to know:

Q. 1. Since chlorine is a poisonous gas, what uses does it find in our everyday life?

A. 1. Chlorine, a greenish yellow gas with a very disagreeable odor, is used mainly in the manufacture of bleaching powder. Being a very active element, it decomposes many compounds, to form more stable ones.

Ordinary salt is composed of sodium and chlorine, yet it is beneficial instead of being harmful to ourselves.

As a disinfectant, chlorine is one of the most powerful. In the purification of water it displaces the oxygen which in this free stage destroys all bacteria. As little as 17 parts of chlorine as a cure for colds, so that instead of all germ life.

Experiments are now being carried out in using chlorine as a cure of colds, so that instead of being injurious to our health, it may be beneficial if diluted sufficiently with air.

OUR $12,000 PRIZE CONTEST

IT will be noted from recent issues and the present one that our prize contest has been a whale of a success. Over $1,000 has been paid out this month for worth while contributions to SCIENCE AND INVENTION, either in pictures, suggestions, ideas or articles. We now have on our staff, close to 14,000 correspondent reporters who are scouting the world for new material that can be written up for SCIENCE AND INVENTION. And the formula is simple—just keep your eyes open. Even if you were totally deaf or blind, you could still win a prize by simply using your head and sending us ideas of a scientific nature, or of a nature directly or indirectly attached to new inventions.

ARTICLES FOR OCTOBER SCIENCE AND INVENTION

How to Judge Cotton, Silk and Linen. By Ismar Ginsberg, B.Sc., Chem. Eng.
New Convertible House with Revolving Floor. By Dr. Albert Neuburger.
A New Explanation of Saturn's Rings.
Magellanic Cloud Stars. By Charles T. Dahama.
Salvaging Sunken Ships—Things You Ought to Know. By H. Winfield Secor, E. E.
Molten Metal Rockets to Combat War-time Aircraft.
The Future and Science—What Can We Expect?
Dirigible Used to Locate Valuable Ore Deposits.
How to Build a Model Steam Boat.
Unique Clocks.
The Earliest American Patents.
What Would Happen if the Earth Speeded Up?
The Science of a "Shower of Fish."

FREE INFORMATION

IF you want additional information concerning any of the subjects illustrated and described in this number of **SCIENCE AND INVENTION** we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope. Make all questions concise and specific.

Address all inquiries of this nature to **INFORMATION EDITOR** c/o Science and Invention, 53 Park Place, New York City.

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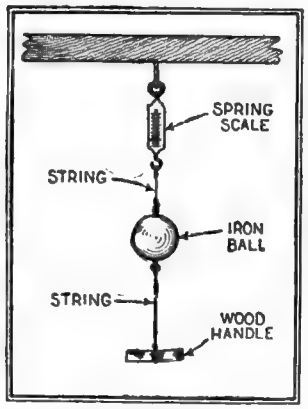
ENERGY

(1735) John M. Wetherill, Schnectady, New York, asks:

Q. 1. What is energy and what are its manifestations?

A. 1. Energy is the capacity for doing work. There are three classes of energy: energy of masses, energy of molecules and atoms and energy of ether.



Were a gradual pull exercised upon the handle, the upper string would break first; as here the total pull on that string would be the pull plus the weight of the iron ball. When a sudden pull is applied, the lower string breaks first, as the inertia of the ball is so great as to keep it from moving before the upper string breaks.

Energy of Masses { Masses in motion—kinetic; Elastic bodies in state of stress. } potential; Gravitation, energy of attracting masses. } potential; Sound—kinetic & potential

Energy of molecules and atoms. { Heat; Molecular & atomic energy; Chemical action.

Energy of ether { Light & Radiation; Electric and magnetic phenomena

Q. 2. Kindly define inertia and give an example?

A. 2. Inertia is the tendency of a body to remain in its state of rest or motion. If a heavy iron ball is suspended by means of a light cord and another similar cord fastened to its lower end, a sudden pull on the lower string will result in that string being broken. The string supporting the iron ball will not be broken. The reason for this is that even before the heavy mass had a chance to move, the lower string was strained to the point where it was broken. If a spring scale were attached to the upper string, it would show little increased reading.

PLATE SUPPLY

(1736) Paul McKinley, West Point, Kentucky, asks:

Q. 1. Can a 32 volt farm lighting plant supply line be used as a source of plate voltage for a WD-11 tube?

A. 1. The 32 volt farm lighting supply plant can be used successfully if you place a 2 mf. condenser across the tube and put a 30 ohm rheostat in series with one leg. It is advisable of course to use this for the detector tube only, as there is not sufficient voltage to operate an amplifier tube very successfully.

FAST GUN POWDER

(1737) Joseph Bartos, Dayton, Ohio, asks:

Q. 1. Can you give me a formula for a good fast burning gunpowder, also a sure burning fuse for fireworks?

A. 1. Probably the simplest formula for you to follow for making gunpowder is the following:

Potassium nitrate, 75 parts.
Charcoal, 15 parts.
Sulphur, 10 parts.

These parts are by weight. It is quite necessary that all the above ingredients be entirely pulverized before mixing, ground in water, dried to a cake, and pulverized.

For fuses the following is used:

Potassium nitrate, 2 parts.
Lead acetate, 40 parts.
Water, 100 parts.

Mix and dissolve, and in the solution place unsized paper; raise to nearly a boil and keep at this temperature for 20 minutes. If the paper is to be "slow," it may now be taken out, dried, cut into strips and rolled. If to be "faster," the heat is to be continued longer, according to the quickness desired. Care must be taken to avoid boiling, which might disintegrate the paper. In preparing these papers, every precaution against fire should be taken, and their preparation in the shop or house should not be thought of. In making the solutions, etc., where heat is necessary, the water bath should invariably be used.

FLASHLIGHT POWDER

(1738) Arthur T. Snyder, Springfield, Idaho, asks:

Q. 1. What is the formula and how is flashlight powder made?

A. 1. Flashlight powder is composed of 6 parts of magnesium dust or powder, to which has been added 12 parts of potassium chlorate. In another dish, 4 parts of aluminum dust, 10 parts of potassium chlorate and 1 part of sugar are thoroughly mixed and the both mixtures, which of course are in a finely divided state, having been completely pulverized separately, are mixed together. Care should be taken in handling to prevent inhaling.

LINEAR EXPANSION

(1739) William J. Hayes, Mulvane, Kansas, says that it is best to put up electric telegraph wires in the summer, while a friend of his says it is best in the winter. Kindly explain who is right.

A. 1. The general practice is to string telegraph wires during the summer and autumn, stringing them as tightly as is consistent with average temperature. Between the extremes of summer heat and winter cold, an average temperature change of 50° Centigrade is not at all uncommon, and a steel wire one mile long will change as much as three feet in length during this period, showing that the wire, if strung too tightly, will pull the insulators from their supports, or if strung too loosely, will, during the summer, sag greatly.

FOUR CYCLE GASOLINE MOTOR

(1740) Oscar Lamond, Baltimore, Md., asks

Q. 1 Will you kindly explain in full detail how the four cycle gasoline motor operates?

A. 1. Vaporized gasoline and air are fed into the firing chamber on the first cycle, the piston drawing the explosive mixture into the cylinder. During the next cycle this explosive is compressed in the cylinder by the rising piston due in part to the momentum of the flywheel and before the downward stroke, a spark passes which is automatically controlled by the timer. The piston returns, forcing the waste gas out on its up-stroke and starting at the beginning of the fifth cycle, the above operation is repeated. This assumes the crankshaft to be below the cylinders. The engine can work in any position.

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

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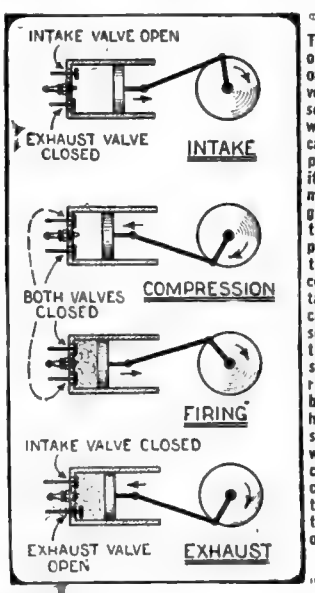


The gasoline engine of today is one of our marvelous inventions, which we so much abuse when driving our car. A simple explanation of how it works, is augmented by the diagram shown. Although very simple in principle, the design of a complete engine entails a very intricate and extensive series of calculations. Speed, strength of materials, lubrication, bearings, valves and heat generated, are some of the factors which the engineers cope with. A two cycle engine does the same work as the four, but in only two operations.

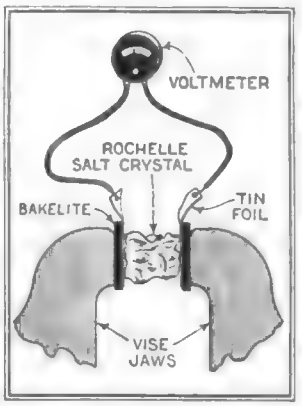
PIEZO ELECTRICITY

(1741) Charles Rubitchek, Glen Head, Long Island, asks:

Q. 1. What is so-called piezo electricity and why is it so called?

A. 1. Piezo comes from the Greek word in the infinitive mood, "piezein," which means to squeeze or press. Many solids in crystal form develop powerful electrical currents when subjected to stress, particularly torsional stresses.

A Rochelle salt crystal clamped between the jaws of a vise, and insulateed therefrom by bakelite strips, is conncted to a voltmeter, and upon tightening the vise, a voltage deflection occurs. Of course the current is small, but if a battery of the cells are connected in parallel, more current will result. Upon passing a telephone current through the crystal the crystal talks.



In the same manner many crystals act in the reverse manner and produce stress when electrical charges are applied to them. By this means we have, obviously a system of converting electrical into mechanical energy and vice versa. These crystals also have the property of rotating the vibratory plane of polarized light and are thus optically active. Among the common substances acting in this manner, are camphor, sugar, quartz, and many solids having asymmetric crystalline structure. Ordinary Rochelle salt crystals seem to give the greatest piezo electrical action and build up remarkably high potentials. Although the action was first discovered in 1880 by Curie, very little has been done in the way of utilizing the effects of the crystal in commercial practice. A great field is open for experimentation along these lines.

CARE OF STORAGE BATTERY

(1742) Mortimer Shapiro, Portland, Oregon, says that he has recently purchased a new storage battery and is desirous of learning the best means of prolonging its life. He asks:

Q. 1. What are the causes for the poor longevity of a storage battery?

A. 1. The three classes of trouble to be encountered with in the use of a storage battery are 1, chemical, 2, electrical and 3, mechanical.

When once put into action, a battery should be used continuously and with the proper care will last five years or more. It should be kept in a clean, dry and cool spot. It should be recharged as soon as there is a noticeable drop in voltage. The electrolyte should always be at least one-half inch above the top of the plates.

Care must be taken to prevent the jars, whether of glass or rubber in the battery breaking or cracking. All terminal connections must be kept clean and the vent holes kept open. Allowing the battery to freeze does as much material damage as does excessive overcharging.

At the specific gravity reading of 1300 and the terminal voltage of two and a quarter volts, a battery cell is fully charged. When the specific gravity falls to 1200 and the voltage to 1.8 volts, it is imperative for the good of the battery to recharge it. The ordinary six volt, 100 ampere hour battery used on automobiles should not be charged at a faster rate than five amperes.

CEMENT FOR MEERSCHAUM

(1743) Ruffner Thompson, Logan, W. Va., says that he has accidentally broken an heirloom pipe and desires to repair it. He asks:

Q. 1. How can I go about it?

A. 1. Macerate several pieces of fresh garlic, having stripped them from their outer hull. This can be done in a mortar, until reduced to a paste.

Dip the broken ends of the pipe into the paste and quickly join the ends, clamping together as tightly as possible. Immerse the joint in some boiling milk and allow to remain for one-half hour, after which remove and allow to cool slowly.

This makes a practically invisible joint which will withstand ordinary rough usage.

STAMPING ON METALS

(1744) John E. Monahan, Dorchester, Mass., wants to know:

Q. 1. Can you give me a process for marking on steel and brass which has been coated with a thin coat of varnish? I want to acidulate the ink and by using a rubber stamp, cut through the varnish and so impress the stamping directly on the metal objects.

A. 1. We do not believe that it is very practical to mix an acid with ink in order to cut through varnish so as to stamp on steel directly. We believe it is much more advisable to use a heated die which will clean the varnish from the steel and then apply the ink, after which it can be revarnished.

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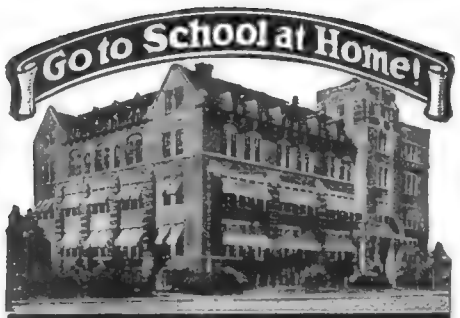

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Doctor Hackensaw's Secrets

(*Continued from page* 500)

In a word, the car would not have traveled to Australia, but Australia would have traveled to the car. That is the principle on which my air express works.

"This cylinder that you see here is my car. It is loaded with merchandise for Australia and I intend to send it off this week."

"But," objected Silas, "didn't you once tell me that if a car left the earth, it would shoot off in a straight line at a thousand miles per hour in the same direction in which the earth was turning?"

"I did, Silas—I see I shall need another diagram. This circle is the earth and the arrow shows the direction of rotation. Y_1 is the position of New York at the time the car is shot off and A_1 is the position of Australia at the same time. C_1 is the position of the car when it starts off on the straight tangent and C_2, C_3, and C_4 are its position at intervals of six hours, since the car receives an impulse of one thousand miles per hour from the rotation of the earth. At the end of six hours the car has traveled 6,000 miles and will be at C_2 while New York will be at Y_2 at the end of twelve hours the car would be at C_3 and New York would be at A_1, while Australia would be at Y_1, the point from which the car was shot. Of course, long before this time the passenger would let in the earth's attraction so as to be pulled back to some new point X where the car would meet Australia. In fact, I should never let the car get more than about a thousand miles from the earth, as I believe the atmosphere there would be sufficiently rarefied."

"But you told me the car would also fly off at a tangent to the earth's orbit around the sun."

"True, but the tangent and the orbit itself would differ so slightly that I could easily make up for the difference by letting in a trifle more attraction from the earth."

"What is the object of that cylinder below the car?"

"That holds ballast to keep the car upright during the trip, for it is important that the screen should always be parallel to the earth's surface."

"Have you found anyone yet to send as a passenger?"

"Yes, I am going to send my fifteen-year-old office boy, Miggs, or I suppose I should say Tintageles Smith."

CHAPTER 4

TINTAGELES SMITH

Tintageles Smith was Doctor Hackensaw's fifteen-year-old office boy. His father, plain John Smith, decided that his son should have a distinctive name. He succeeded, for there is probably no other Tintageles Smith in existence. Tintageles was born a scientist. At the age of twelve, he learned that yellow and blue combined to make green. So he took two small boys, chalked the nose of one with blue crayon and of the other with yellow crayon, then compelled the boys to rub noses together until a beautiful green resulted. At thirteen, Tintageles found a position, and with the first money he saved, he bought a revolver and started for the Wild West "to fight the Indians." His father caught him, however, before he had gone fifteen miles, and after a spiritual *séance* in the woodshed, Tintageles found standing more comfortable than sitting for a couple of days afterwards.

Finally, at fifteen, Doctor Hackensaw, hearing the story, decided that a lad with sufficient ambition and enterprise to emulate Buffalo Bill, would make a valuable assistant, and accordingly took him into his employ. He knew he had chosen wisely, when he learned later that Tintageles had paid a public stenographer to write him some love-letters addressed to the office; which letters the boy would apparently by accident display to his fellow-clerks, so that the words: "My own precious darling," or "Loads of kisses from your own little tootsie-wootsie Mabel," would drive them wild with envy.

Now it is a sign of culture to be able to pronounce the name Tintageles correctly. It rhymes with "sneeze" and the accent is on the second syllable, and the g is soft. As the office boys were not over-anxious to show off their culture, they nicknamed him "Miggs"—a most inappropriate name, for he *looked* as if his name was Tintageles.

Miggs had begged hard to be allowed to accompany the doctor on his trip to the moon. Doctor Hackensaw, on refusing, had promised to take him next time; and so it happened that Miggs was chosen to pilot the Negative Gravity car on its trip to Australia.

On the day appointed for the start, Miggs appeared sharp on time; all ready for the trip, as was evidenced by a copy of the "Nickel Library" and a pamphlet "How to Become a Detective" peeping from his pocket.

"Aren't you afraid to go alone on such a trip as this, my boy?" asked Silas Rockett, patronizingly.

"Nope!" responded the lad monosyllabically, with a curl of the lip. Without another word, he entered the car through a door in the top, closing the opening behind him.

In order to avoid all chance of accidents the machine was timed by clock-work to start and return automatically, the boy, however, having been taught how to modify his speed in case of necessity, by opening or closing the anti-gravitation screens.

At the appointed time the screens began automatically closing, and as they did so, the air above becoming lighter, the car was gradually sucked up until it was high in the air, the speed of the vehicle gradually increasing as more and more of the earth's attraction was shut off.

"I hope no harm comes to the boy!" said Silas, with some emotion, as he clambered down from the platform, followed by the Doctor.

Doctor Hackensaw heartily echoed the wish.

CHAPTER 5

THE FLIGHT

Miggs was delighted as the car arose in the air and he felt the peculiar sensation of lightness due to the cutting off of some of the earth's attraction.

Although cautioned by the doctor not to "fool" with the instruments, his first care, when about twenty-five miles from the ground, was to close the screen completely, cutting off all attraction from the earth. This was delightful. Away he shot at a speed of about one thousand miles per hour. But to his surprise he was pushed against the western side of the car, for the atmosphere, though extremely rarefied at this height, offered an appreciable resistance to the car's progress, while there was no resistance to his own. However, he soon got beyond the limits where the air had any appreciable effect on the car's flight. Then the last vestige of his weight left him and he found he could swim about in the air or somersault around in the car in a way that would have made a circus acrobat green with envy.

To his surprise the sun and the stars

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stood still, there would no longer be any morning, noon or evening for him, for the rotation of the earth no longer affected him. He, like the sun and stars, was now a heavenly body and viewed from the earth would seem to be revolving around it once every twenty-four hours, rising in the east and setting in the west.

For one hour Miggs allowed the car to rush through the heavens and then gradually checked its speed by letting in more and more of the earth's attraction, until after a journey of about a thousand miles, he brought the car to a complete stop, and then allowed it to fall toward the earth, its velocity increasing about thirty-two feet each second of the fall. When the speedometer indicated a speed of one hundred miles per hour toward the earth, Miggs regretfully shut off the gravitation again, allowing the car to continue downward by its acquired velocity. When he reached within a few miles of the earth's surface, the atmosphere became dense enough to retard the car considerably, and he was obliged to let in a little more attraction in order to get up speed again.

Unfortunately his interference with Doctor Hackensaw's nicely regulated adjustments resulted in upsetting the doctor's calculations, for the car landed in India instead of Australia, and Doctor Hackensaw, anxiously waiting for news of the car and its cargo, received the following characteristic dispatch by wireless:

"Mistake somewhere. Landed here in India instead of Australia. Car lost. Some fresh kids, fooling with it, closed the screens and the car went up like a flash. It must be near the moon now. One of the Hindoo kids went up with it. Please send good wad of money by cable. Mail bunch of detective stories to San Francisco, so I can have something to read on way home. Miggs."

The Heavens In September

By ISABEL M. LEWIS, M. A.

(*Continued from page* 475)

Looking now a little to the southeast of Vega we come upon another star of special interest in Lyra. This is Beta Lyrae, which is known as an eclipsing variable star. In a period of twelve days and twenty-two hours, with the greatest regularity, this star goes through a cycle of light changes, due to the periodic eclipse of the brighter star by a faint companion revolving about it in a plane that is nearly in line with the earth. So once in each revolution the faint star must pass between us and its companion and shut off part of its light. The variation in the light of this star amounts to about three-fourths of a magnitude. There are a number of these eclipsing variable stars in the heavens, another well known star with light changes due to a similar cause being the Demon Star, Algol, in the constellation of Perseus now appearing above the northeastern horizon.

On a line from Beta Lyrae to the star nearest to it on the southeast known as Gamma Lyrae, and at about one-third of the distance from Beta is a wonderful object visible even in small telescopes, though seen at its best in the great reflectors. This is the Ring Nebula in Lyra consisting of a bright star within a ring of nebulous light. There are a number of similar objects in the heavens but this is the most beautiful one of this class and the only one visible in small telescopes. How this nebulous ring is formed is still very much of a mystery, though it is probable that it represents some form of emanations from the central star or a product of its gradual disintegration.

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latitudes, a beautiful object in the midst of the star clouds of the Milky Way with the first magnitude star, Deneb, one of the twenty brightest in the heavens, at the head of the cross and the finest of double stars, Albireo, at its foot.

Altair, the first magnitude star in Aquila, is now nearly due south. It also is one of our near stellar neighbors, somewhat nearer than Vega, for its distance is placed at somewhere between fifteen and twenty light years. If a line is drawn from Albireo at the foot of the Northern Cross to Altair and continued as far again it will bring us to another interesting object, the wide naked-eye double star Alpha in the constellation of Capricornus, which star can be easily distinguished as a double star without the aid of a telescope. Just a little to the south of Alpha Capricorni we find the star Beta Capricorni, which is somewhat brighter than Alpha. Capricornus is an inconspicuous constellation containing no stars brighter than the third magnitude, but the configuration formed by the wide double Alpha and the nearby Beta will aid in identifying this constellation which once contained the point marking the farthest southern excursions of the sun, a spot now found in Sagittarius, the next of the zodiacal groups on the west.

To the east of Capricornus in the constellation of Aquarius, The Water-Bearer, we will now find Mars in all of its glory, the most magnificent object in view, even more resplendent than Jupiter, which is still visible in the western sky. Mars made its nearest approach to the earth on the twenty-third of August, but on September 1st it is at a distance of 35,200,000 miles, only about half a million miles more distant than it was on the twenty-third, and for the greater part of this month it will remain nearer to the earth than it has been for a number of years. By the 30th of September its distance will have increased to 43,650,000 miles, which is less than its distance at an average opposition.

The brightness of Mars will show a noticeable decrease during the month of September. On the first of the month it will be more than twice as bright as Jupiter, but by the thirtieth of the month the two planets will be almost equally bright, with Mars a little the brighter of the two.

Those interested in studying the surface markings of the ruddy planet will probably be particularly busy this month, while the planet can still be seen to the best advantage. It is probable that observations will also be made with powerful telescopes of the two tiny moons of Mars, Deimos and Phobos, each of which is less than twenty miles in diameter and which were first discovered by Asaph Hall, Sr., with the twenty-six inch equatorial of the U. S. Naval Observatory at the favorable opposition of August, 1877. So small and faint are these two satellites of Mars and so close to the brilliant planet that they are only observable with the most powerful telescopes and it is a considerable astronomical feat to detect them.

Answers to Scientific Problems

(*Continued from page* 473)

THE FLOATING BEAM

Two forces may be considered as acting upon any floating body. One, directed downward and due to the weight of the body, may be considered as acting at the center of gravity; the other, due to the buoyant force of the liquid, is directed upward from the center of buoyance. If the two centers are not in a vertical line the forces tend to rotate the body around until the centers of gravity and buoyance are directly one above the other. Furthermore, since the buoyant force tends to raise the center of buoyancy it is evident that the body is in its most stable position when the center of buoyancy is highest and its center of gravity lowest. Fig. 1 represents an unstable position because the center of buoyancy is not directly below the center of gravity. Of Figs. 2 and 3 the former represents the more stable position, for the center of buoyancy is not only directly below the center of gravity but it is also higher up.

THE BELL CIRCUIT

The correct hook-up is shown herewith.

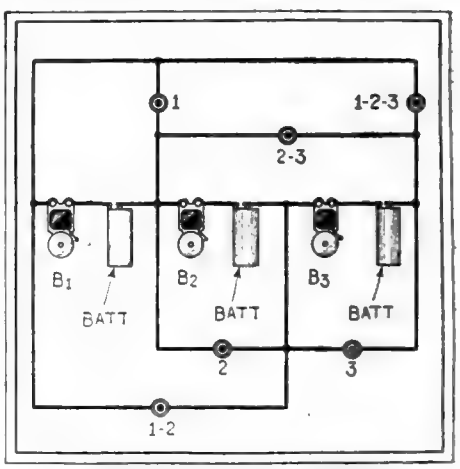
THE PUZZLE PICTURE

The following inconsistent or erronious situations are represented:

1. In the latitude of New York shadows do not point south, nor is a rainbow visible in the north.
2. Of course, New York is not 500 miles west of any coast.
3. The rainbow should be represented in the form of a circle, not of an ellipse; the clothesline in the form of a catenary, not of a circle; the stream of water from the hose in the form of a parabola instead of the arc of a circle.
4. Both man and dog are walking in an unnatural manner.

DESCENT FROM ONE PLANE TO ANOTHER

When an object falls or rolls from one horizontal plane to another the potential energy or energy of position which the body has on the upper plane becomes converted into kinetic energy or energy of motion on reaching the lower plane. The potential energy is measured by the product of the weight of the object into the vertical distance through which it can fall or roll. The kinetic energy is proportional to the weight of the object and the square of the velocity



Solution of the electric bell ringing problem.

with which it moves. If no energy is lost, the potential energy equals the kinetic energy and the relation may be expressed by the equation $Ws = \frac{W v^2}{2g}$ in which W represents the weight of the object, s the distance between the planes, v the velocity on reaching the lower plane, and g the acceleration due to gravity. The left hand member Ws represents the potential energy of the body on the upper plane and the right hand member $\frac{WV^2}{2g}$ the kinetic energy on reaching the

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lower plane. Solving for V^2, we see that $V^2=2gs$ and hence is constant for all bodies regardless of their weight. Of course, in practice some energy would be lost in friction and the bodies losing the least energy by friction would reach the lower plane with the highest velocity. It should be noted that it has not been said that all bodies would reach the lower plane in the same time, but theoretically at least or neglecting friction all bodies should reach the lower plane with the same velocity. The body on the cycloid will descend the quickest. The cycloid is termed the brachystochrone, as it is the curve of quickest descent. Also, it will take a body the same time to roll down the entire curve, or to go only a part of the descent if always ending its course at the bottom.

THE GRAVITATIVE WHEEL

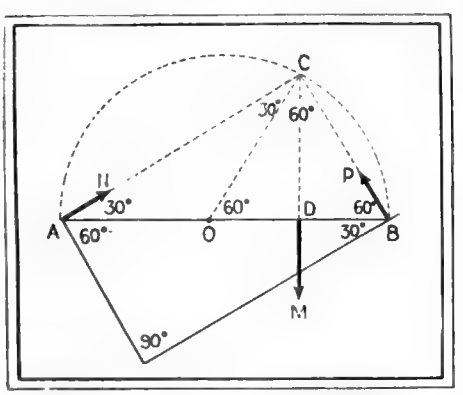
This system will not work because of the opposing pressure that is produced in the region where the casing bears against the lower wheel. The action is very much like wringing a garden hose through the wringer when the hose is full of water under pressure. It can be shown that the moment due to this back pressure exactly equals the moment due to the weight of the water in the casing. Hence the wheel would not start turning even if friction were reduced to a minimum.

THE SINKING BALL

As the ball rotates it tends to drag some of the water around with it. This water will tend to increase the pressure on the right hand side which is moving downward and decrease the pressure on the left where the edge is moving upward. Hence the ball will be deflected toward the left slightly as it sinks.

PLANK ON ICE

If an object is held stationary by three or more non-parallel forces the direction



Relation of forces in plank on ice problem.

lines of these forces must intersect in a common point. In our problem the downward force DM of the boy's weight is balanced by the reaction forces AN and BP perpendicular to the walls of the ravine. For equilibrium, then, the three direction lines AC, DC, and BC must intersect in a common point, C. From the figure it is evident that BC=OB=OA=½ AB, and, by similar triangles DB=½ CB=¼AB. Hence if the plank is not to slip either way the boy must stand one-fourth of the length of the plank from the end B.

THE ICEBOAT

Let SS represent the sail of the boat, AO the direction and magnitude of the force of the wind against the sail. Then BO represents the component of this force perpendicular to the sail and CO the useful component that moves the boat forward. Now, since the boat is not sailing directly away from the wind it is certain that no matter how

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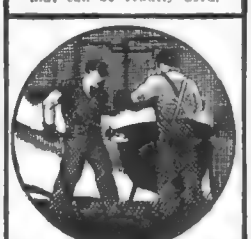

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fast it goes the wind will always be producing pressure against the sail and hence will tend to constantly increase its velocity. Then if friction is not too great there is no reason why the speed of the boat cannot considerably exceed that of the wind.

THE AVIATOR'S RACE

At first it may seem that neither aviator has an advantage over the other on account of the wind, for will not the wind help and hinder aviator B by equal amounts since it opposes him over the same distance that it helps him? To answer this let us suppose the wind blows with sufficient velocity to prevent the return of the aviator against it. Then he could go very quickly with the wind but would never be able to return and complete his trip. Thus we see that the wind really hinders aviator B more than it helps him, for it hinders him for a longer time than it helps.

Book Review

VOICES FROM ANOTHER WORLD. By F. Gurtis. Nom de plume for Willabald Frank. Translated by Lilian A. Clare. Stiff cloth covers, 5¾" x 8½", 243 pages. Published by Dodd, Mead and Co., New York City. Price, $3.00.

With the words of Arthur Schopenhauer, the author introduces this work, and we must agree with the introduction that there does not seem to be any definite purpose for the work. The assumption is made that all would-be communications with the spiritual world are actually produced by the subconscious mind. This is not a new theory to be sure, inasmuch as it has received considerable prominence during recent years. The author found an instrument with which communications with the spirit world were to be obtained. This machine was similar to the Pantograph. The investigators would sit around it and place their finger tips on the ends of the machine, and a point would then stop at letters in the alphabet progressively arranged in a square chart. The machine never did work for the author and his wife, but would only give results when other people were present in the séance with the author. The "Psycho-graph," as that is the name given to the machine, did not to this extent differ with our ouija board, but its appearance was different, although its manner of operation was much the same.

After a short introductory discussion, the greater part of the work takes up the history of records, and is in fact a transcript of questions and answers produced during a series of séances with various persons who were requested to sit in. Many places, names, locations, and incidents were recalled which we thought to be entirely unknown to any of those sitting in, and on being checked up in an encyclopedia were found to be definite occurrences which were invariably correct. In parts the work resembles a farce; in other places it is crude, and in still other portions of this work, vulgarity is predominant. As an attempt at a scientific book it falls far short of the mark. Its greatest redeeming feature is the description of the Psycho-graph, which description if followed carefully might enable any other individual to construct a machine of a similar type and play with it. Drawing the same conclusion that the author does, namely, that the answering of the questions is the working of the subconscious mind, we could question the character of some of the individuals who assisted in forming the records which occupied at least two-thirds of the work, but being cheerful law-abiding citizens, we will not do so.—K.

LIGHT AND WORK. By M. Luckiesh. Hard covers, 6" x 9", fully illustrated, 296 pages. Published by D. Van Nostrand Co., New York City. Price $4.00 net.

Dr. Luckiesh, following his usual course of treating a subject which might be quite obstruse, makes it thoroughly interesting and has produced a book which can be read consecutively with great enlightenment and pleasure. A great deal is known about illumination, but it is really pathetic to see how little use is made of that knowledge. A slight difference in the color of a wall will impair the illumination of a room greatly, and impairing illumination means running up the bills for light supply. The writer has sat in a room with varnished pitch pine walls with a strong kerosene lamp by his side, and found that reading could not be done in any comfort. It seemed that in the room all the lamp could do was to make a hole in the darkness, and yet when people are decorating their houses, they remorselessly put on paint which impairs the illumination. The practical points are brought out toward

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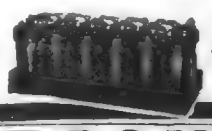

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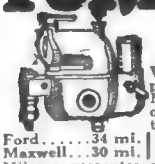

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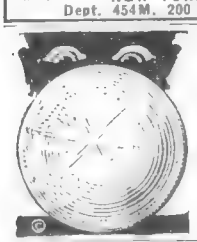

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the end of the relation of visibility and safety where it appears how many accidents are occasioned by improper and inadequate lighting. It is claimed that about twenty per cent of all traffic or industrial accidents are due to this one cause. Even color blindness is spoken of, and for stopping car signals red and blue-green are recommended, in that not one in one hundred thousand persons would have trouble in distinguishing these colors. At the end of the book is a list of Dr. Luckiesh's other works, and while these appear as advertisements, we strongly advise the reader to read them through, and he will then realize why we say that Prof. Luckiesh has the rare faculty of awakening human interest in difficult scientific subjects.

HOUSEPAINTING. By Alvah Horton Sabine, M.S. Hard covers, 5" x 7½", 160 pages. Published by John Wiley & Sons, Inc., New York City. Price $3.50 net.

Dr. Sabin has a number of books on paint and varnish to his credit, and here we have one addressed to the householder. It is quite interesting reading and the high cost of labor has had the effect of inducing many householders to do much work about the house which they otherwise would not dream of attempting. Very interesting features of this work are those where the author goes into the subject of proportions of oil for mixing paints, the square feet which a definite amount will cover, both in regard to old or new wood, and all other material which comes under the title of the book. Brushes receive considerable space, which is eminently proper. White lead poisoning is included. The aggravating subject to the amateur of glazing is treated of. We are glad to see that he recommends bedding window glass in putty when putting it into sashes. Removal of old paint is described and the book has an aspect of practicability and efficiency throughout.

ELEMENTS OF WATER BACTERIOLOGY. By Samuel Cate Prescott. Hard covers, 6" x 9¼", illustrated, 205 pages. Published by John Wiley & Sons, New York City. Price $2.50 net.

It has taken mankind many long ages to wake up to the effects of insects and low forms of life upon his system. This very elaborate treatise covers the subject of the bacilli found in water, of intestinal bacteria, of the significance of the colon group in water, and the bacteriological relations of sewers. It took a long while before Koch's discovery of the relation of the mosquito to malaria was taken with even a small degree of seriousness, and the wonderful work done on the Isthmus of Panama by Dr. Gorgas in the elimination of yellow fever, put the seal of approval upon Koch's work. Today the mosquito is being scientifically exterminated and malaria is disappearing from what were infected regions along with the disturbing insects. An interesting chapter in this book covers the examination of shell fish for bacteria, for it is realized that oysters may produce typhoid fever if they have been propagated in contaminated water. A most valuable portion of the work is the twenty-nine page bibliography of the subject. A full subject index is given.

THE A B C OF ATOMS. By Bertrand Russell, F. R. S. Hard covers, 5¼" x 7¾", 162 pages. Published by E. P. Dutton & Co., New York City. Price $2.00.

Mr. Russell's clear, concise style has been used, in this volume, to explain the most abstruse of the scientific theories. The whole subject of atoms is extremely complicated, and unless the writer has a very clear conception of the subject itself, and has the ability to state clearly and simply what he thinks, the result will be pretty much of a mess as far as the layman is concerned. However, Mr. Russell reviews the subject in such a way that the man in the street will not be required to read many paragraphs more than once in order to get the gist of the subject, and have a fairly complete understanding of the points which Mr. Russell wishes to bring out. The book is divided in such a way as to make the following of the subject very easy. From the discussion of the Periodic Law, he passes on to a discussion of electrons and nuclei. Then he has an illuminating chapter on the spectrum. The theory of quanta, X-ray activities and the structure of nuclei are also dealt with. Then there is a couple of chapters given to the new physics and the wave theory of light, and a cursory discussion on the Theory of Relativity. The mathematics of the whole volume that is, as much of it as it is possible to omit from the actual discussion, is given in an appendix where a complete mathematical discussion on Bohr's Theory of the hydrogen spectrum is to be found.

THE MIND IN ACTION. A Study of Human Interests. By George H. Green. Hard covers, 5½" x 8", 223 pages. Published by G. P. Putnam's Sons, New York City. Price $2.00.

This volume is another of those books which have been coming from the presses in a more or

(*Continued on page* 520)

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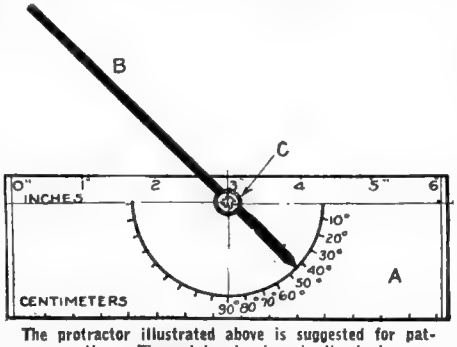
PENCIL SHARPENER PROTRACTOR AND AND PHONE RECEIVER HOLDER

(821) Louis M. Rawlins, Jr., Baltimore, Md., asks whether he should patent the protractor illustrated herewith; a bracket to hold a telephone receiver while talking into the phone leaving one arm free and an automatic electrical pencil sharpener.

A. We are of the opinion that the automatic protractor which you have designed is non-patentable, but in order to definitely determine this you should have a patent search made by a reliable attorney. We frankly believe that the possibilities of this protractor are very limited, and do not think that a patent upon the same would be of any value.



The protractor illustrated above is suggested for patenting. The opinion is given in the text.

This magazine published a photograph of an automatic arm to hold the receiver of a telephone while talking into the same. There are about forty such on the market. Most telephone companies do not permit the use of such attachments on their telephone. This suggestion is not new.

An automatic electric pencil sharpener is a rather old idea. It is likewise expensive. We also published an article on how one reader converted a regular pencil sharpener into an automatic electric one by using a motor and a telephone jack to close the circuit. This appeared over a year ago.

We do not advise applying for a patent upon any of the three ideas submitted by you.

NON-MAGNETIC STEEL

(822) L. Bacevicz, Elizabeth, N. J., suggests that ships and ship parts be of non-magnetic steel. In this way the compass would not be affected by the presence of iron or steel in the ship's make-up. He asks if a patent on a process for producing non-magnetic steel would be of value.

A. There are many steels which are non-magnetic or very slightly so. For instance, ferro-manganese is but slightly magnetic; nickel steel the same, and the steel alloyed with other materials is sometimes but slightly magnetic.

On board ship where the metal of the vessel causes changes in the magnetic compass, such steel could be substituted or corrective measures (such as are used at present) could be employed. The gyro-compass, however, is doing away with the effect which steel vessels produce.

Undoubtedly a patent might protect a process of producing such a substance, but what advantage such a patent would have we are not prepared to state. We doubt if it would be very great.

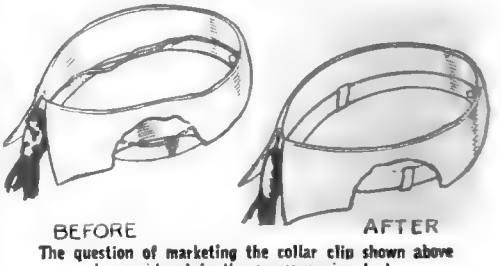
MARKETING

(823) H. Bidwell, Minneapolis, Minn., asks how he can market a collar clip ready for distribution.

A. It is very difficult to make suggestions on the collar clip, which you are placing upon the market. There are thousands of ways of marketing such an invention. For instance, you could advertise for salesmen to handle this product, and then create agencies throughout the country, or you could offer the goods to reputable houses on consignment to be accounted for at the expiration of two or three months. Under condition that you receive at the end of one or two months, either the return of the original products or else a certain definite sum for those sold. Newspaper and magazine advertising is of very great value, as is advertising at beach resorts by street venders.

Circularizing is another good method of advertising, but it is expensive, although not quite as expensive as consignment advertising.

(*Continued on page* 510)



The question of marketing the collar clip shown above is considered in the accompanying text.

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VARIABLE CONDENSER

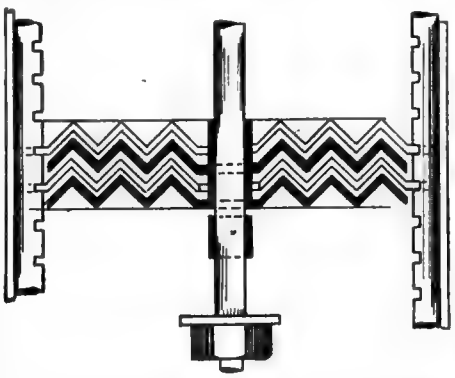
(824) Carlos Bohnenblust, Managua, Nic., C. A., submits a suggestion for variable condensers in which the plates are corrugated to produce greater surface area.

A. The variable condenser which you have designed is very poor indeed. Even though you do obtain a greater plate area in such a variable condenser, its construction is entirely too expensive.

A much better method of developing variable condenser plates is to make them in such a form that a thin layer of insulating material covers both surfaces of either the movable or rotating plates. In this way, there is no possibility of shorting the condenser, and the space between two plates is reduced to a minimum. Consequently the capacity of the condenser is greatly increased.

In your particular device the slightest bend in either group of plates would cause the condenser to be shorted. This condenser will clog with dirt much more easily and it would be relatively difficult to clean. It is also difficult to correct shorted plates.

We would not suggest that you apply for a patent on this device, as we do not see how you could possibly secure a sale for the same, even if a patent was granted.

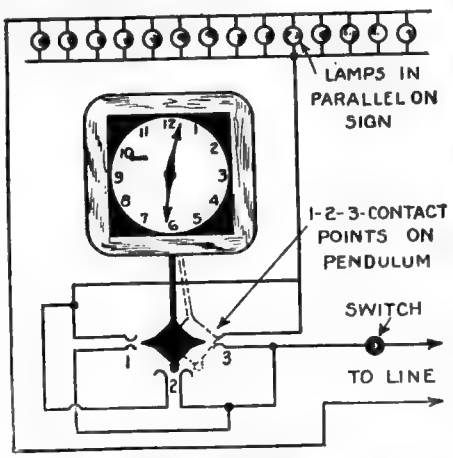


By corrugating the plates of the variable condenser the inventor believes that he will increase the surface area, and consequently the capacity of the condenser, without increasing its size. A patent is not advised.

SIGN FLASHER

(825) E. A. Ramsay, New York City, submits a suggestion for a sign flasher, the nature of which is made clear in the illustration.

A. We certainly would not suggest your applying for a patent on your lighting apparatus. The idea is very poor and the possibility of controlling so many lamps from the pendulum of a clock is worse than poor. The flashing taking place at the contact points, and the effect in retarding the movements of the pendulum is too great to even make the device worthy of consideration. Systems, equally simple, controlled by small motors are far superior.



The sign flasher indicated is not thought worthwhile, and application for a patent is not suggested.

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The Man On the Meteor

By RAY CUMMINGS

(*Continued from page 459*)

They vanished in a swirl of water. I wheeled my dolphin toward Atar. His ten light-sleighs were in a line abreast, with him on his dolphin behind them. He gave a signal. The pods on the sleighs were unshrouded. Green light leaped ahead—a broad, blinding glare; and in the semi-darkness behind it, my electric men were gathered around me.

Then I shouted my command, and we started vertically downward—our first attack upon the enemy.

II

The glare of light showed the water plainly—a brilliant, ghastly green. We reached the sea-bottom, turned and dashed forward. The Maagogs were there. They saw our light coming of course, long before we saw them. A crowd of them, confused, half-blinded, but they were standing their ground nevertheless.

Over the line of light-sleighs I saw that we had to deal here with perhaps five hundred Maagog men. They seemed armed with spears. They huddled heavily against the sea-bottom, some half a mile from the edge of the forest. The line of them stretched back there, and more were constantly coming out.

When our sleighs were no more than a few hundred yards away, I shouted at Atar. At his relayed signal, the sleighs shrouded their pods and turned upward, out of reach of the enemy. It left the water in semi-darkness—blackness it must have seemed to the Maagogs, with that blinding glare so suddenly extinguished.

And then we leaped at them.

It was a swirl of confusion, this hand-to-hand warfare. I held my dolphin resolutely above it, taking no part, but watching for every advantage into which I might hurl my men.

Looking down into the swirling water I could see the Maagogs fighting desperately to impale my swimmers with their spears. And my young Marinoids, darting over them, up and down, seeking to touch them head and legs simultaneously that the electric shock might kill them.

The fighting spread. Soon it was going on over a wide area. It was almost silent, uncanny fighting. The swish of the churning water—a shout, a death scream here and there. Bodies were dotting the sand. Maagogs, but Marinoids too. And the Maagogs in this first engagement outnumbered us two to one.

I was perhaps fifty feet above the sand, with the sleighs poised inactive immediately over me. Atar dashed up.

"How are they doing? Nemo, would it be better in the light?"

I had not thought of that. A trio of Maagogs, wounded and confused, came floundering up at us. Atar, from his dolphin, dispatched them easily with his sword.

"The lights!" he shouted. "Lights—and spread out—to light it all."

The lights flashed on; the sleighs moved away to separate positions.

As though on a lighted stage, the scene was now illumined. It was a good move, for the Maagogs, living in the dark Water of Wild Things, could not stand the light as well as we could.

THE CASUALTIES

Back to the edge of the forest the fighting was in progress. But my heart sank There were two Maagogs dead to every Marinoid; but it was not enough These were the weakest of Og's forces—and I was using against them the best of mine. Half an

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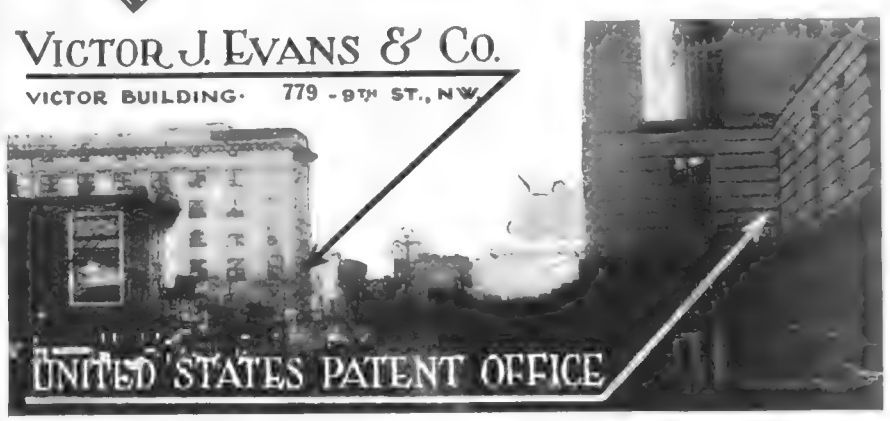

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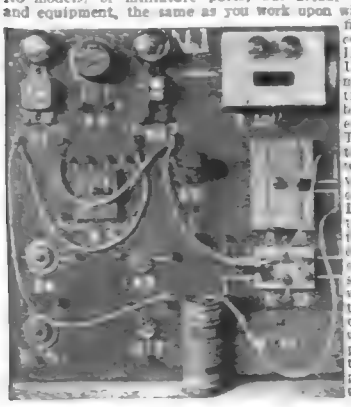

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Nona stared into the girl's pathetic little face.

"Go," she said. "You speak truth, Maaret. You belong there with the man you love, no matter for what cause he fights. Go!"

Her gaze followed as Maaret dropped away, down into the recesses of the forest.

IV

It was a terrible moment as we saw those black fishes, with Og in their midst, dashing at us. Atar and I shouted to our men—shouted encouragement. We could not avoid this new enemy; and so we had to plunge at it with a will. A hundred electric men, no more, and all of them were exhausted by the combat they had left but a moment before.

Our light-sleighs were of little use here; hastily we sent them speeding upward, to bring down our main army to our assistance. Atar and I on our dolphins circled about. The black fishes were everywhere; confusion again; the lashing figures of our young men as they met the black, ugly little things—all jaws, and teeth like needles.

A hundred personal battles simultaneously. But there were ten fishes to each of our men at least. The fishes were shocked and killed—some of them. Others bit and tore at our fighters' flesh.

Have you ever seen a school of hungry fish pluck at a bit of food? Dismember it—carry it away? This was like it. . . .

Shuddering, I dashed my dolphin to and fro. A few of the fishes I caught on my lance. But so very few among that thousand. . . .

This was disaster. We would kill half the fishes perhaps—but lose all this portion of our men. Disaster. . . .

I became aware of Atar's dolphin rushing past me; his voice shouting:

"Og! Let us get Og! Force him to call off the fishes! Or kill him!"

Og had been holding himself poised in midwater, watching the scene. But already he had realized his danger. He was making away; and at his call a hundred or more of his fishes gathered around him.

We would have dashed at them; our two dolphins could have scattered them.

But we did not; for from below, a swarm of other figures appeared. Marinogs! The half-breeds! A picked corps of Marinog youths. They were good swimmers. They possessed the power of electric shock. More than a hundred of them were rising now to Og's assistance.

Atar and I stopped our onslaught. Around us on every hand our scattered forces were fighting the fishes. But the little groups of men fighting were now very few; everywhere bodies were sinking inert, with swarms of fishes plucking at them. . . .

We screamed for all to follow us who could; and mounted. A few of our men tried to follow—but not one succeeded. The oncoming Marinogs, fresh and lustful, caught them all.

And with hearts cold within us, Atar and I dashed on upward, alone.

V

Nona regained her mount above the forest, and continued on to join her girls. I can tell you this part of the battle only as Nona told it to me—briefly, for my Nona talks little of her own deeds.

The girls on the dolphins were beyond the forest, down near the sea-bottom. And they were engaged with the enemy when Nona arrived.

It was the last of the Maagog columns, just entering the forest when the dolphins attacked it. A very brief engagement. A few score of the last, heavy-swimming Maagogs. And without trouble the girls cut them down—drove them into the forest.

Atar and I, rising alone from our defeat, met our main army coming down to help

100

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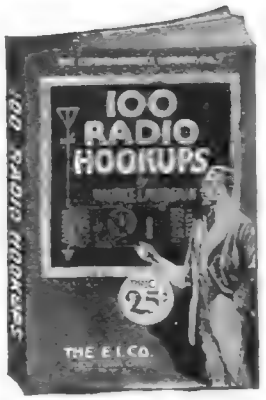

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us. The light-sleighs had carried the news.

Hastily we told them of our disaster. It was my fault, no doubt; I should never have split my forces. How easy it is to look back and say what should have been done!

Atar was anxious to descend at once, with all our men, in one desperate attack. But I was learning the art of warfare. Inexperienced still, yet now not wholly so. We must wait here, I told them, for Nona and the girls to return. Then we would be completely united. And by then the enemy would be on this side of the forest. In the open, we would attack them with all our forces at once, as Atar said.

"Look!" shouted Atar.

Above us, in the direction of the forest, the blur of swiftly moving forms showed, with lines of white, V-shaped, behind them.

VI

It was Nona and her girls—victorious in what they had undertaken. The news heartened us. We had lost a few of the girls and dolphins—and two hundred and fifty of our best men. But we had done the enemy all told a more than equal amount of damage.

For half an hour we waited. Atar and I twice cautiously descended. The Maagogs seemed all out of the forest—and were advancing on Rax. High over them in the water, we followed; and almost within sight of Rax, we dove down in a mass upon them.

It was a scene of carnage which at first seemed inextricable confusion. My forces spread out—attacked the enemy everywhere at once The Maagogs seemed to prefer the sea-bottom; they clung there and fought stubbornly.

At Atar's insistence, I held my dolphin at first in mid-water, out of range of the fighting. Below me was the center of the struggling mass—the main force of sword-armed Maagogs. Against them, in the glare of Atar's light-sleighs, I hurled my older men. They were fighting down there in the brilliant light. We were outnumbered in this section, but I could see that my men were more than holding their own.

Off to the left—toward the forest—a cloud of the black fishes had come up. With them were the Marinog electric men; and against them I sent my own two hundred and fifty youths—and the girls and dolphins.

It was this segment that I most feared. I could see them now; the men were locked in hand-to-hand conflict—lashing the water—hundreds of little groups. The black fishes were mingled with them; and about the whole struggling mass, the girls on the dolphins dashed back and forth.

How long I watched I do not know. I was alone, save that near at hand were Caan and his dark-sleighs, holding themselves in readiness.

A Marinoid fighter came wavering up to me, wounded and gasping.

I descended. The fighters in this central melee had split into two separate sections—and on one side were far outnumbered. Atar was down here; he saw me, and rushed forward.

THE INK POTS

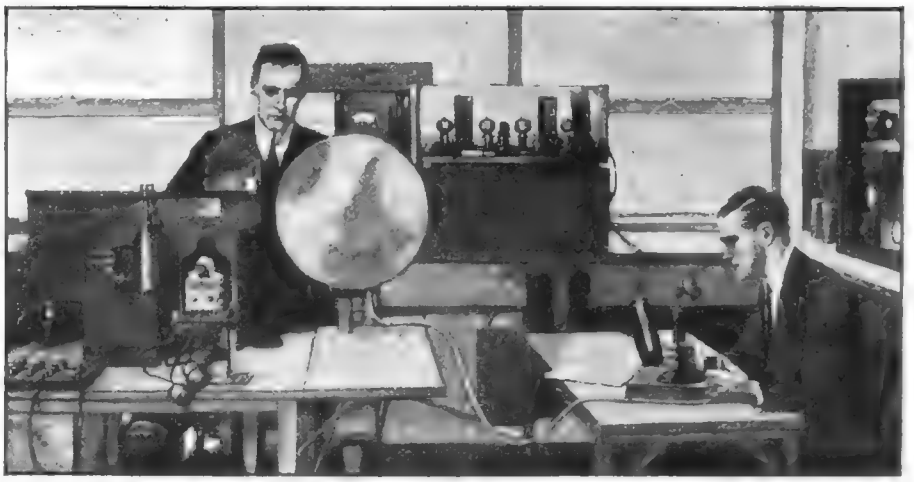
"Nemo—on this side we lose."

It was impossible to transfer quickly any considerable number of my men from one side to the other.

"Take the lights from the losing side," I shouted; and when Atar had dashed away, I swam my mount up to Caan.

With his dark-sleighs, we swept down into the threatened area. Men were fighting all around us; the dead were everywhere. The ink-bags on the sleighs released their fluid; the water darkened—turning to night.

Back and forth I scurried through the darkness, screaming to my men to shake off their foes—to extricate themselves and rise



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into the light. In the blackness my dolphin struck many struggling forms—friend and foe alike.

Then I went up, out of the cloud of ink, again into the blessed light. And waited, while in little groups, my sorely pressed fighters struggled up after me.

It was instinct for everyone to escape from that horrible darkness. Have you ever fought in the dark? It strikes a terror to the soul.

The Maagogs must have felt it, as well as my own men. In the black, inky water, all fighting soon ceased.

And here I saw my opportunity and grasped it. The Maagogs, confused and terror-stricken, were floundering out into the light. They came singly. And their eyes—weaker than those of the Marinoids—could see little when first they emerged.

For many minutes the inky water held together. And around its edges, Atar with his light-sleighs swept their dazzling beams back and forth. There were six or seven hundred Maagogs in there—and as they came out a few at a time, we fell upon them.

It was our great opportunity. And then I realized that I could do the same thing with the other wing. If only I had my other forces here! The girls with the dolphins!

Atar and Caan executed the same maneuver, while I dashed away to get Nona. In this third sector things had gone very well indeed. The girls had suffered few casualties. They were fighting the Marinogs—holding them in cheek, while my electric men dispatched the black fishes.

I searched about for Nona, came upon her in time to see what manner of warfare this was. Three Marinogs had made for her. She went at them full tilt, with lance extended. They scattered; but incredibly swiftly she turned her dolphin, impaled one of them with her lance—then another, while the third for his life, turned and made away.

"Nona!" I called. "Bring your girls! Come—we need you!"

With the girls behind me, I hastened back to Atar and Caan. Out of the inky water below—into the brilliant beams of our light-sleighs—the surprised Maagogs were emerging. The girls rushed at them—the dolphins, extraordinarily swift, seemed to be everywhere at once. . . .

The ink finally cleared away; and my own remaining fighters took a hand. The combat turned to slaughter—then a complete rout.

. . .

And I had men free now to send to the other sector, weakened by the withdrawal of the girls. The black fishes and the Marinogs there were overpowered. The fishes fought to the last. A few of the Marinogs fled—back to the Water of Wild Things. And from everywhere about the scene of battle, wounded Maagogs were floundering away.

But we let them go.

We had won.

VI

Concluding Statement by Ray Cummings

I feel that I should add a few words to this last manuscript given me by "Nemo." You will recall that I have already told you he is an inmate of one of our State Homes.

Each month this queer old man has been writing for me these memories of his youth. But the Institution officials, with pardonable skepticism, declare to me privately that he is unbalanced—a victim of amnesia since that day he was found wandering on the streets of an American city, with no memory of who he was or where he came from. They tell me he was, in his youth, probably some obscure European astronomer—which would account for his scientific knowledge. Scandinavian perhaps, they now say. His accent is curious. I can hear for myself. But I

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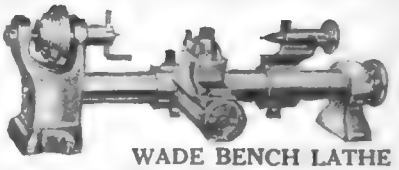

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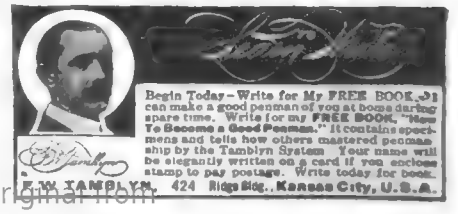
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would not call it Scandinavian; indeed I have heard nothing like it anywhere.

It was not so many weeks ago—dating from the time you read this—when I interviewed the old man, in the neat little reception room of the Institution. I read over this last manuscript which he handed me, while he sat staring with eyes that seemed to see far beyond the narrow walls enclosing us.

"But Nemo," I protested, "this is not finished. Is this the last you're going to give me?"

"The last," he said vaguely. "I cannot remember any more. It is getting blurred—fading." He passed a palsied hand across his blue-veined forehead. "Getting blurred—for I am an old man and my faculties are going—very fast."

"But Og," I suggested. "What became of Og?"

He brightened. "Did I not tell you that? I remember now. I met him—near the end of the battle. He had captured one of our dolphins, and a lance. He came at me—and I fought him—I was mounted as he was. . . ."

The tired old voice trailed away.

"Yes?" I prompted.

He started. "What was I saying? Oh yes, about Og. You asked me about Og, didn't you? We might have been knights of the Court of King Arthur—jousting with our lances. I can remember it now—clearly. I would have run him through almost at the first tilt, but that girl threw herself between us. I did not like to kill her. That was bad. Accidental—I could not help it."

"You mean Maaret?"

"Maaret? Yes, that was her name, wasn't it? I remember now. She died in Nona's arms—after I had killed Og. The girl did not know I had killed him. She died—still loving Og, and glad that she had given her life for him. . . I remember that now."

It was all fading in his mind; I realized that, and made a last effort.

"But Nona and your boy? What of them? And you, Nemo—who are you?"

He seemed struggling with the shadows that were enveloping him.

"I—I don't know. I remember that at the last, I was with Nona and boy. The war was over. I was sick. Yes, that was it—very, very sick. They had me in bed. Nona was bending over me. I can see her now—so beautiful. It was getting dark, but Nona said——"

He stopped short.

"Nona said——" I prompted gently.

"Yes, I recall it now. Nona said I must fight the darkness that was creeping upon me. But I couldn't. It came—darkness and silence. Slowly. But everything was growing black. And Nona's voice imploring me not to go, grew dimmer—far away—dimmer and darker—everything dark, and then—I was gone."

"Dead?" I said softly. What did he mean? What could it all mean, except what the rational officials of the Institution said?

He shook himself slightly. "Did I say dead? I don't know whether I mean that or not. I don't know what I mean. Blackness—nothingness—and then I found myself on one of your horrible crowded streets here on Earth. An old man—cheated out of all those years of life—grown old and feeble, when last I had been young and strong. And my Nona and boy gone——"

He was trembling now; and suddenly he turned on me.

"Go away, please. It—it hurts me to think these thoughts. My Nona gone——"

If any of you care to advance your theories, I shall be glad to hear from you.

And I thank you, on Nemo's behalf, for your interest these past nine months.

RAY CUMMINGS.

THE END.

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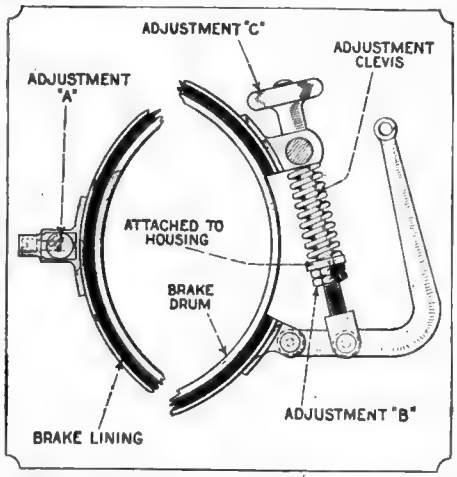
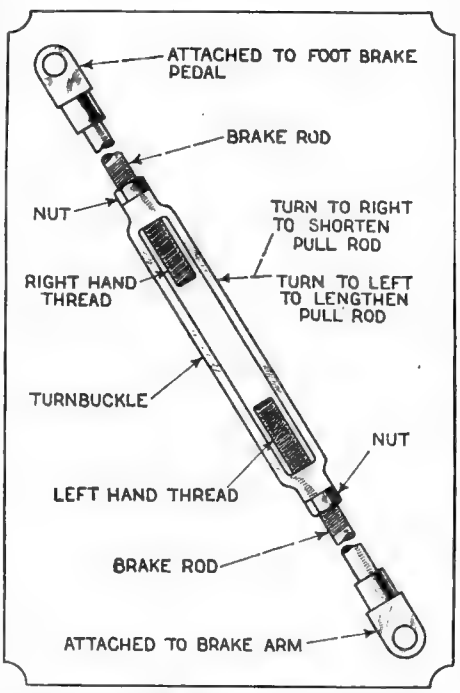
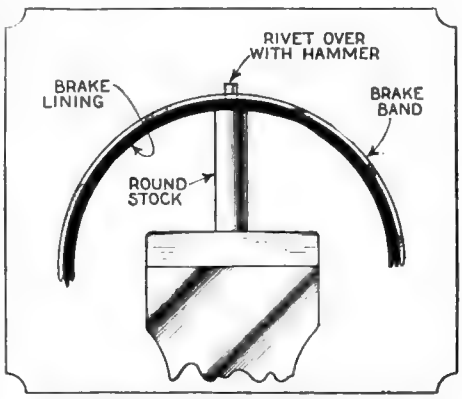


The three adjustments for brake bands are designated above. First turn A to the right until the wheel, when turned by hand, just drags. Then tighten the screw. Next turn nuts at B downward until the band is as close to the drum as possible, without making a wheel drag. Then turn C down in the same manner, being sure that the wheel turns perfectly freely.



After adjusting the bands, adjust the pull-rod turnbuckles so that the two brakes, right and left, take hold at the same time and brake evenly.



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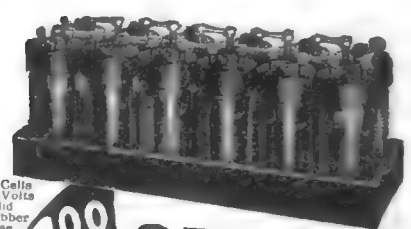

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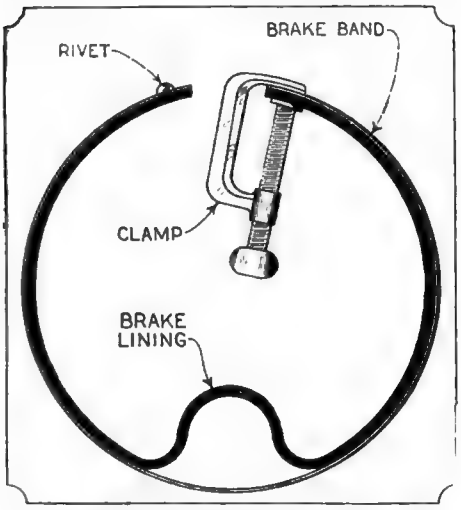
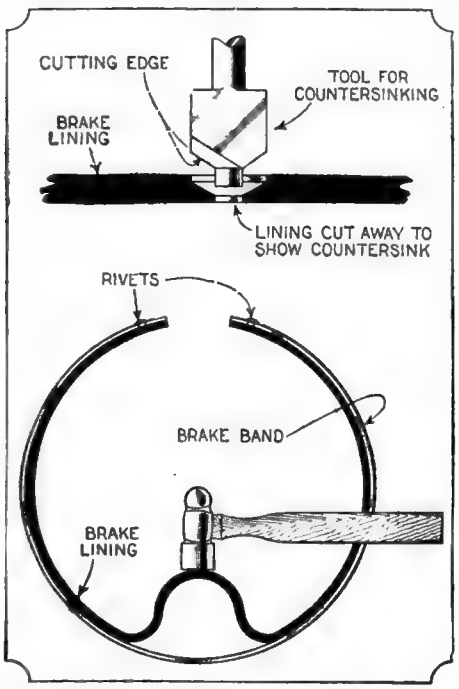
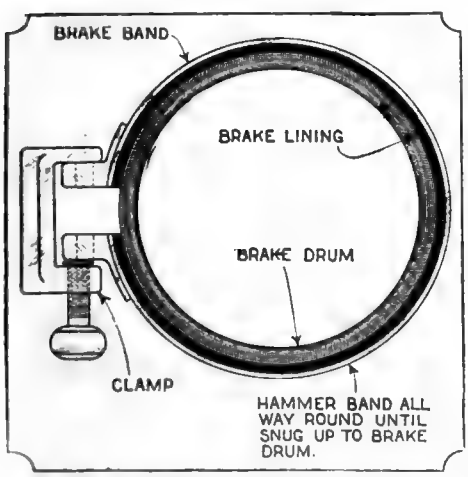


To replace brake lining, cut lining about one inch longer than the band, rivet one end, hold the other with a clamp, and then hammer down the bow in the center until the lining fits the band very snugly.



After placing the band, as indicated above, countersink and drill the lining for the rivets. Then rivet the two ends to the band and go through the hammering process again, after which the remaining rivets are installed, as indicated in the bottom sketch on the previous page. Much care must be taken to see that the lining fits the band snugly, and that the two conform in shape all the way around.



In order to form the new lining to the band, it is often expedient to clamp the new band and lining about the drum which it is to fit when installed. A method of doing this is clearly illustrated above. After clamping the band to the drum, hammer it evenly all around.

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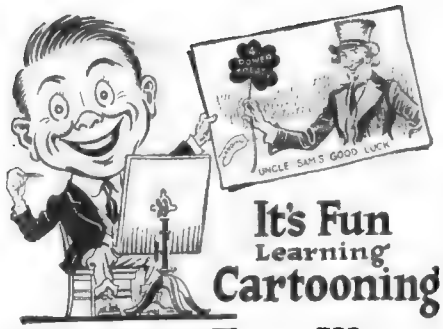

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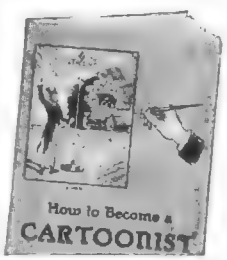

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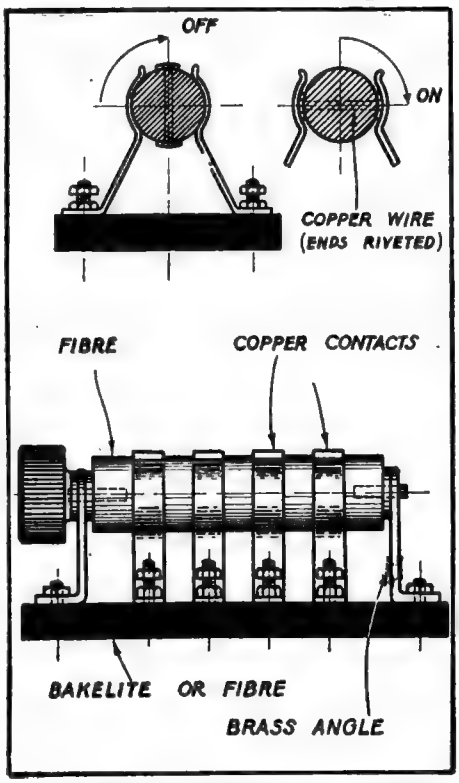
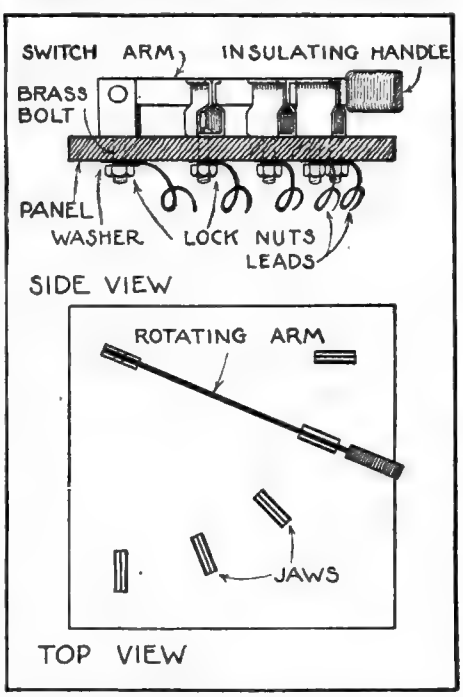
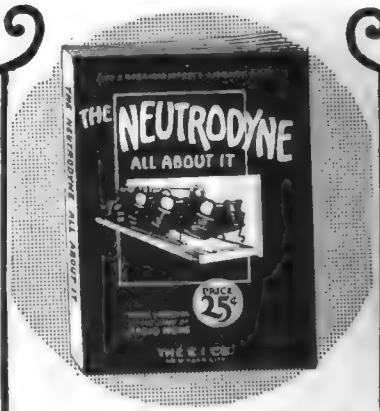


In many places in radio receiving sets and in experimental apparatus, rotary switches are very desirable, but the majority of them are rather difficult to construct. However, the one illustrated above overcomes many of the troubles and can be conveniently mounted. It may be made with any number of contacts, four being shown in the above illustration. Two brass strips bent as shown in the side view of the switch are necessary for each circuit that is to be closed. Heavy copper wire is passed through holes in the fiber rod and riveted on each end so as to form a connection between the two brass strips when turned to a certain position. The fiber rod carrying the contacts may be mounted in any manner such as panel mounting.
—William B. Chambers.

POSITIVE CONTACT SWITCH



Where a considerable amount of power is to be carried by a switch there are sometimes considerable losses at the contact points. This can be eliminated, when a multi-point switch is to be employed, by making use of the various parts of standard knife switches, as illustrated above. As many switch jaws as there are to be contacts in the completed switch are provided and mounted in a semi-circular form as shown. A switch arm is then journalled and provided with lock nuts so that it can be readily revolved through the required arc without loosening. The rest of the construction is obvious from the above illustration.—George Martin.



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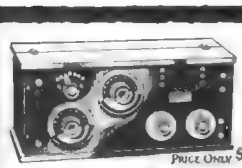

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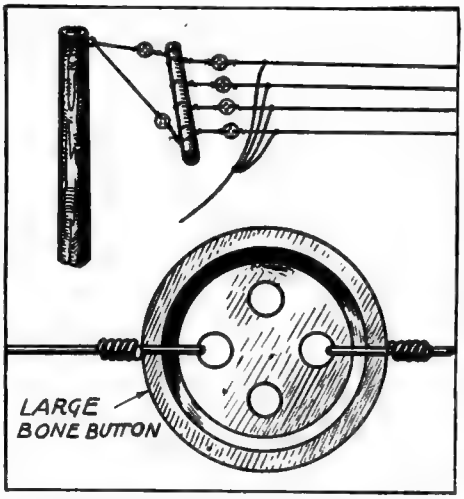
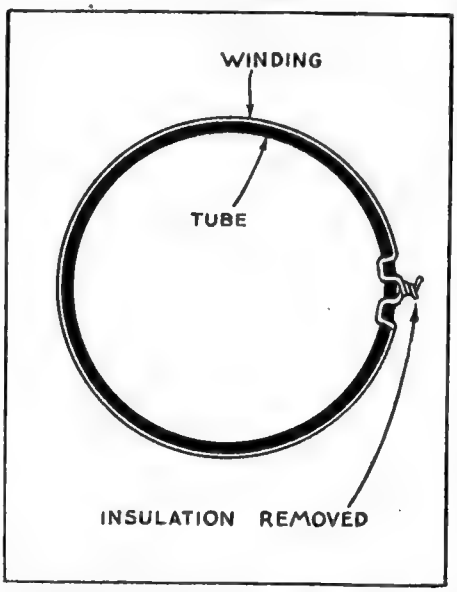


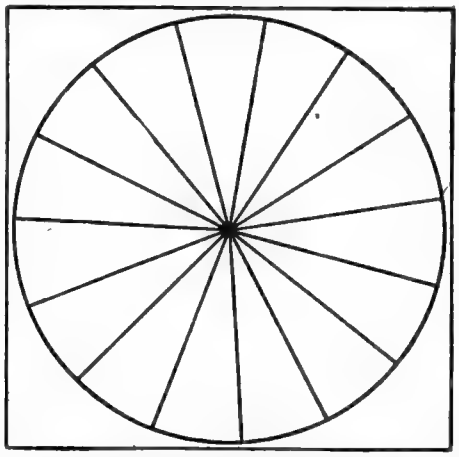
For small aerials where little strain is placed on the insulators, large bone buttons may be used as illustrated above. Two or three may be used in series for better insulation. —Harold Jackson.

TAP KINK



The diagram above shows an excellent method of providing points at which taps are to be taken off a coil. Four holes are drilled in the tube as shown and the wire passed in and out of them after being cut off. The insulation is then scraped from each end of the wire and the ends twisted together. Extension leads to go to switch points may then be soldered to this twisted joint, making sure that the solder sweats into the twisted portion.—W. E. Leach, Reporter No. 3127.

REINARTZ COIL PATTERN



When you are going to construct a Reinartz coil, obtain a disk of wood 2 3/16 inches in diameter and paste the above pattern on one side of it. The points where the diameters intersect the circumference indicate where the thin sticks should be inserted for winding the [illegible] coil. —Daniel R. Axford.

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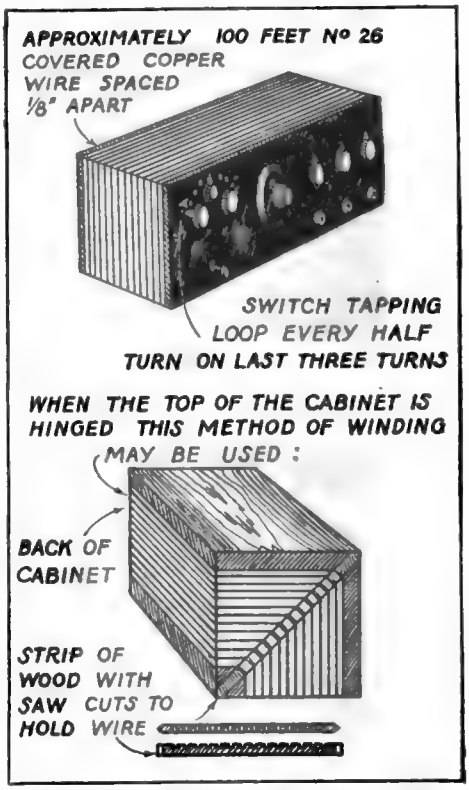
A CONVENIENT LOOP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BACK OF CABINET
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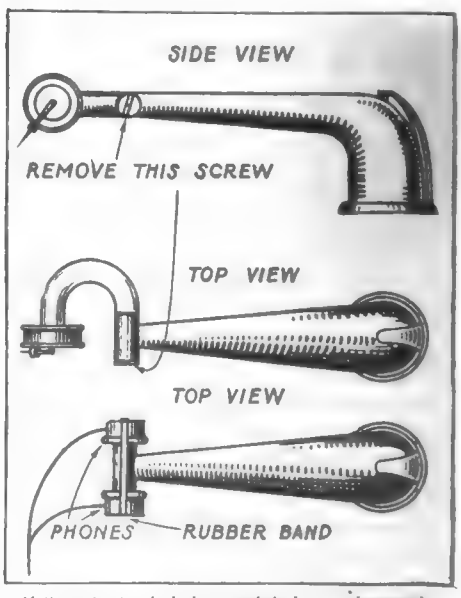

If the radio bug is lucky enough to have a phonograph, the tone arm of which is constructed as shown above, he can attach his phones thereto in a very few seconds. All he will have to do is to remove the screw shown, whereupon the reproducer and the curved arm can be removed. The phones can then be placed one on either side of the resulting tube and fastened thereto by means of a heavy rubber band as shown in the lower part of the above illustration. —Paul F. Bryant.

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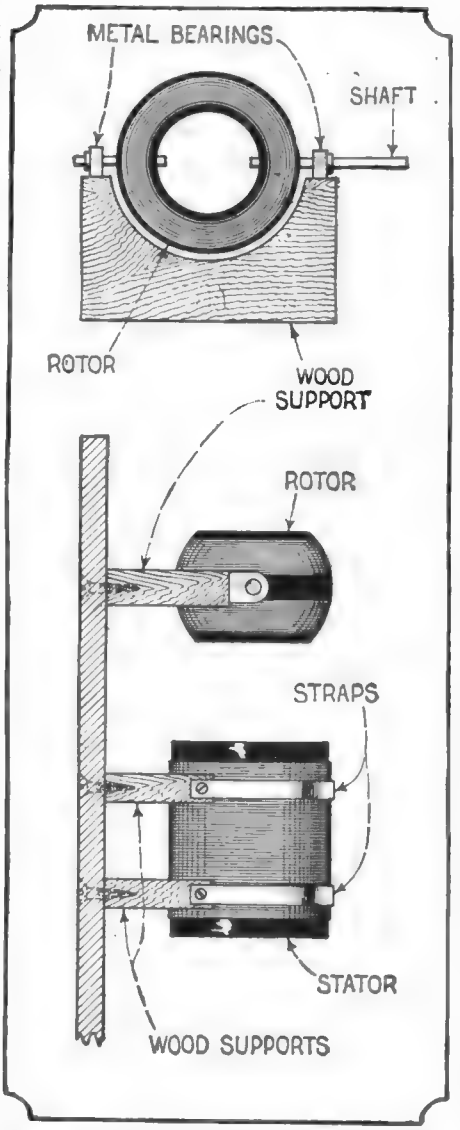
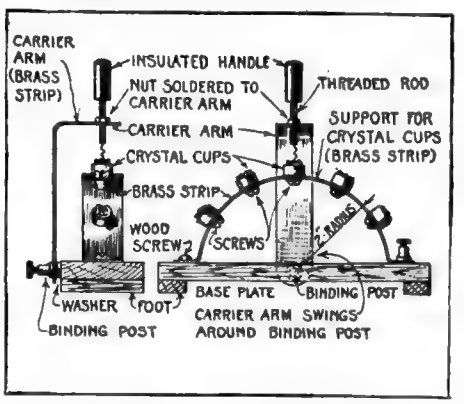


When it is desired to have very loose coupling between the rotor and the stator, trouble is often experienced in mounting the rotor. One of the simplest methods of doing this is to cut a saddle from three-quarter inch wood as shown in the upper part of the above illustration. The rotor is then mounted, any handy type of bearings being used. Saddles of the same style may be used for mounting the stator as illustrated. The rotor mounting could be so arranged that it could be moved nearer to or further from the stator, thereby giving greater flexibility. —Russell Erwin.

MULTIPLE DETECTOR



For experimental purposes, an excellent multiple crystal detector may be constructed as shown above. The cups containing the crystals are rigidly fixed on a semi-circular support while the arm carrying the cat whisker may be revolved through a semi-circle. In this way several different types of crystals may be tested out against each other without having separate detector stands. Connections are made to the two binding posts shown. —C. A. Oldroyd.

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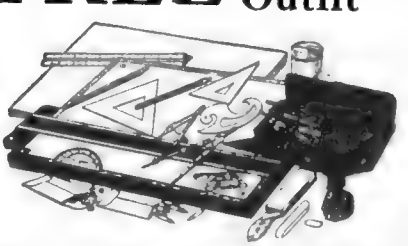

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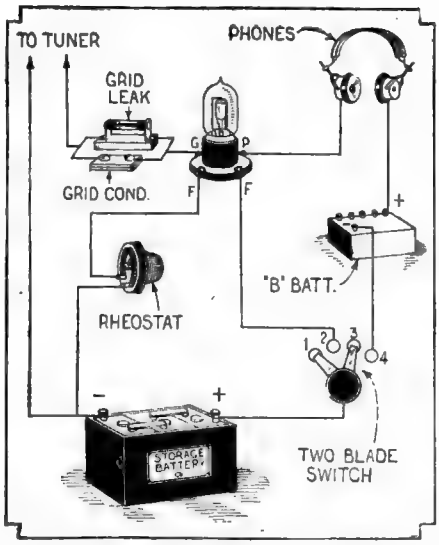
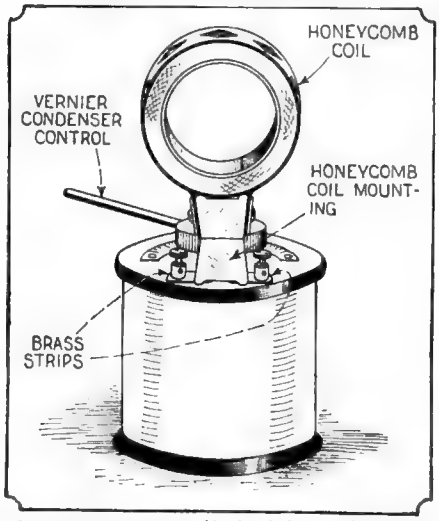


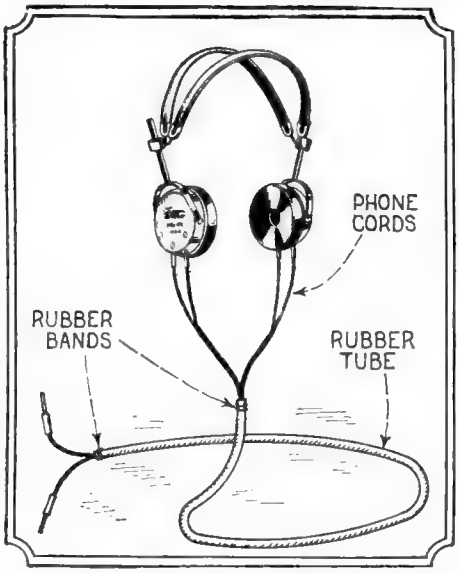
By means of the simple two blade switch shown connected up in the diagram above, the "A" as well as the "B" battery circuits are opened or closed with one movement of the switch knob. —Verl A. LaVanway.

SIMPLE WAVE TRAP



Anyone possessing an old closed type variable condenser and honeycomb coil can readily make this wave trap. A 35-turn honeycomb coil base is secured to the top of the condenser with screws, and each terminal of the H.C. coil connected to the terminals of the condenser. —Nestor Barrett, Reporter No. 6425.

ANTI-TWIST PHONE CORD



The tendency of phone cords to twist may be overcome by slipping a rubber tube over the cord, as shown. A small rubber band is doubled and slipped over each end of the rubber tube. —B. G. Switzer.

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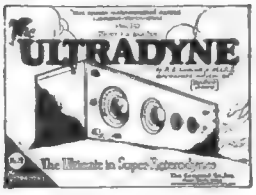

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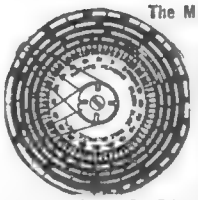

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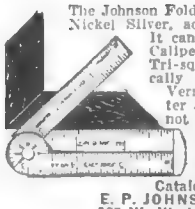

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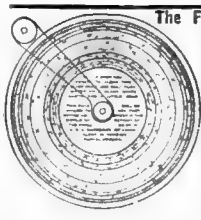

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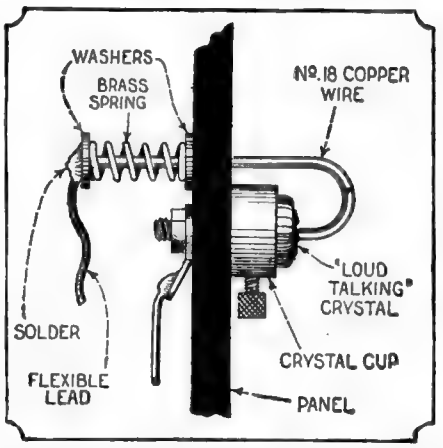
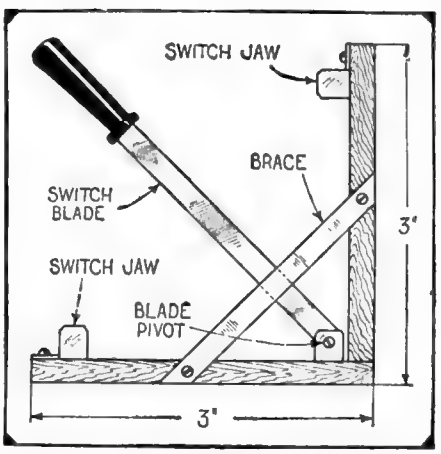


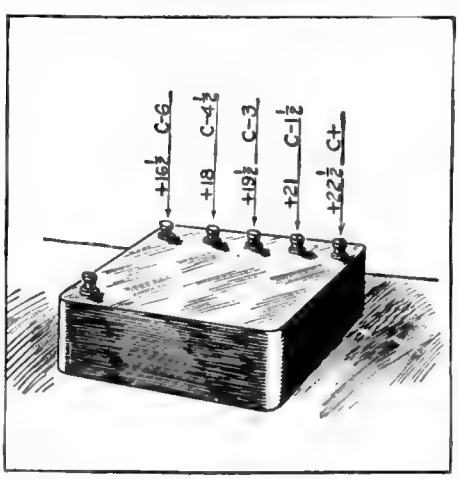
A detector that will stay put and is very efficient for "B metal" and other loud-talking crystals, that require a large contact and heavy pressure, is shown in the drawing. The cat whisker is made of No. 18 hard drawn copper wire and has a blunt contact point. A stiff brass spring is used to supply the proper tension. —Bunnie Chambers, Reporter No. 2254.

QUICK THROW AERIAL SWITCH



With the ordinary double-pole, double-throw knife switch, such as is frequently used for switching from "send" to "receive," there is too much delay and movement required in manipulating this appliance. The drawing herewith shows how the switch may be rebuilt, so as to be thrown in half the time and with much less physical effort. —W. R. Daniels.

USING "B" BATTERY AS "C" BATTERY



The picture above shows how to connect up wires to an ordinary "B" battery so as to be able to obtain the desired potentials for "C" battery service. The 22½ volt terminal of the "B" battery is used as the positive terminal of the "C" battery. —John Bruen.

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If You Had A Face Like A Monkey

you would try to change it. But just because you wear a pair of pants and a coat to cover the rest of your body you don't seem to care a rap what you look like from the neck down. Come on out of it fellows. Get wise. Don't you know you can't keep this up? It's only a few years and ZOWIE it's too late. Your body is clogging up with all kinds of poisons. The only way to get rid of these poisons is to drive them out. Exercise wears off the worthless tissue, the blood carries it to the surface and then you sweat them out through your pores. That's simple enough. But if you don't—your blood will absorb all this poison and soon you're nothing but a human wreck.

I MAKE STRONG MEN

No one likes to look at a narrow-shouldered, flat-chested dyspeptic. Such a man is no good to himself or anyone else. It's the strong, robust, energetic man who gets ahead. He is admired and sought after in both the business and social world. No matter where you find such a man, he is the whole works

Come on then—snap into it. Right now—this minute. This is your day. This message was meant for you or you wouldn't be reading it. I'm all set and waiting for you, and oh boy! what I do to you will sure open your eyes. I'm going to push out that chest of yours, broaden your shoulders and put a pair of arms on you that will carry the kick of a mule. I'm going to build up your whole body with good, solid muscle. I'm going to strengthen every vital organ and shoot a quiver up your old spine that will make you feel like a jack rabbit.

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Just because a man is built like an ox doesn't mean he can show you how to be the same way. There are plenty of strong men today who couldn't tell you how they ever did it. I made my reputation teaching and building others. And my biggest achievements have been made during the past year—not ten years ago. My instructions are modern and up-to-date. When you come to me your success is assured. I don't promise strength—I guarantee it. Are you ready? Let's go.

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Readers Forum

(*Continued from page 476*)

Guadalupe Peak in Culberson and Hudspeth Counties is 9,500 feet high.

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Eagle Mountain in Hudspeth County, 7,510.

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All of these peaks are in Texas. There are few people who know that Texas has eleven mountains which are higher than "the highest peak east of the Rockies."

Sam J. Helm,
Grand High Priest, Grand Royal Arch,
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Corsicana, Texas.

(*Mount Mitchell is 6,711 ft. and is listed as the "highest peak east of the Rockies." We are pleased to give this correction.—Editor.*)

FROM REPORTER NO. 12627

Editor, *Science and Invention:*

I received your reporter's card one week ago and have made use of it in going aboard one of the United Fruit Steamers at Boston. This ship, the 'La Marea,' is the most modern of the fleet of beautiful boats. While being shown over the ship, I picked up the material for an article.

John J. Fisher, Reporter No. 12,627.
Wollaston, Mass.

(*In general, people are glad to co-operate with our reporters if they in turn are courteous. We wish to publicly thank the officials of the United Fruit Steamers for their aid.—Editor.*)

A BRICKBAT

Editor, *Science and Invention:*

I sent you a manuscript describing a tire and file cleaner. It was returned because the matter was too old. I wish to say that this contest is not fair. Just listen to this. In the July number on page 277 you published an article by A. Blumenfeld wherein he tells how to cut glass under water with a pair of scissors. Now I read how to do this in a "What To Do" book published in 1912.

Also you published on page 277 an article by Ben Zyl telling how to make a paper ladder that would be of no use whatsoever. I also read how to do this in the same book. Also you told how on page 276 to balance an egg by using sand. (Salt.—Ed.) That is so old that my father, who is sixty years old, knew how to do it when a child.

Milton White,
Sacramento, Calif.

(*There are times when old material does get into the pages of this journal, but is that any reason why we should expect only old material? Some of the old ideas are practical and are not very well known. Consequently they bear repetition. Some have been published within the past few months and, therefore, will not stand repetition. So don't be discouraged if one or two ideas have been returned. The third may be accepted and pay far more than the effort expended in sending it in. Besides looking for new things is good practice. This is* YOUR *magazine. If it were full of old material you wouldn't look at it. So let us have the kind of material you would like to read.—Editor.*)

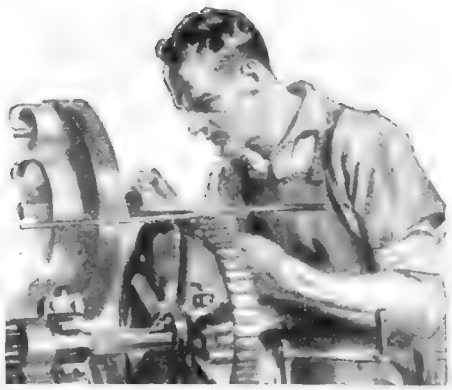
IS THE SUN COLD?

Editor, *Science and Invention:*

Articles have appeared at different times on the subject of the Mystery of the Sun's Heat, some stating that astronomers believe the sun is at least a billion years old, and a solid ball of coal, the size of the sun would be consumed in 5,000 years. So we must look elsewhere for the source of the sun's heat. I submit a few thoughts on this subject.

There are several reasons for believing that the sun is not a burning mass. Combustion means consumption, and for untold millions of years the sun has been the source of light and heat, with no apparent diminution as far back as man has a record. According to the Mosaic account of the creation, light was the first thing created—naturally the sun. Before the earth was, the sun was established, and it has been giving light ever since—how many million of years we know not. Is it reasonable to suppose that the sun has been a burning mass all this time without being consumed, or at least diminished in power?

Secondly, the sun is approximately 92,000,000 miles from us, and the intervening space is supposed to be occupied by a gaseous (?) body called ether, its estimated temperature to be over 100 degrees below zero. We know that the farther we get away from the earth's surface, toward the



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sun, the colder it becomes. How can the heat from the sun pass through this extremely cold space without being absorbed? It naturally could not. The heat we experience is evidently generated by the passage of the sun's rays through our atmosphere, and where that atmosphere is most dense (at the earth's surface) the heat is the greatest.

Third, during an eclipse of the sun, when the body of the moon apparently covers its surface, there are seen by the aid of telescopes, scintillations like flames of fire, extending sometimes 100,000 miles from the sun's surface. Is it reasonable to suppose that flames of fire can be extended to such a height?

Fourth, Prof. Sherman, an astronomer of Canada, several years ago discovered the connection between the sun spots and our *aurora borealis*, or Northern Lights. The latter we know are electrical.

Fifth, the moon receives the light of the sun, but there is no evidence of heat, our satellite having practically no atmosphere.

These facts would seem to prove that no heat comes from the sun, but the heat we experience is the result of the sun's rays passing through our atmosphere.

What, then, is the composition of the sun? No one knows. Some imagine it may be of some substance similar to radium, which has the power to throw off light and heat for a great number of years. But even radium loses its power in time, and its rays are so intense as to burn human flesh.

Did you ever stop to consider that the sun's rays and electricity travel at the same rate of speed—186,000 miles a second? We know there can be no life without electricity, and if the sun's rays are electrical, is it not reasonable to suppose, then, that the sun is an electrical body? Does not this assumption solve many of the questions under consideration?

E. H. Betts,
Port Angeles, Wash.

(Mr. H. Gernsback has taken up the subject which you have mentioned several times in his Editorials in SCIENCE AND INVENTION Magazine. *In one particular Editorial on SCIENTIFIC PARADOXES found in the April,* 1921, *issue of* SCIENCE AND INVENTION *Magazine, the following interesting thoughts appear.*

"We actually know that all heavenly bodies gravitate in a perfect vacuum. Thus we know that if we were to rise only 500 *miles above the surface of the earth, we would find ourselves in an absolute vacuum. We furthermore know that out in space the temperature in this vacuum is—*459.4 *degrees F., i. e., absolute zero. We can demonstrate by experiment that heat cannot be propagated in a vacuum by conduction or by convection. An ordinary thermos bottle readily proves this. Fill the latter with boiling water, and the outside will stay cold, due to the vacuum separating the inside and the outside of the bottle.*

"The case of the sun and the earth is analogous. Heat proper cannot flow between these bodies immersed in a perfect vacuum and besides separated some 92 *million miles. So we see that we do not and cannot receive radiant heat rays from the sun.*

"Paradoxically enough we know for sure that we get heat somehow in spite of our logic. How? Scientists have a vague notion about it, but they are not too sure. They now think that when the ether waves, devoid of all temperature coming from the sun at a speed of 186,000 *miles a second strike our dense atmosphere, the terrific impact results in heat; it is analogous to a meteor, which at a temperature of absolute zero, striking our atmosphere, goes up in metal vapor, due to the enormous friction set up. So we see that after all we do not get heat from the sun at all, merely ether waves, which by shock or impact are turned into heat."—Editor.)*

RAILROAD GATES

Editor, *Science and Invention:*

I notice for some time there have been appearing in your excellent Patent Advice Department, articles regarding safety crossing gates for the railroads. Your Mr. Kraus always advises against patenting such systems.

I wish to give my opinion on such matters. In the first place these gates cost too much and life is cheap to the railroads. The small number of people killed in such accidents does not cost the railroads as much as the cheapest gate installed at every crossing in the country. The roads would rather pay, say twenty-five thousand a year for damages than to pay five or six hundred thousand to install gates. I wish to call to your mind that accident at Porton, Indiana, when the New York Central flyer crashed into the Canadian train. Well I got to work and made a model of my idea to prevent such accidents. It was impossible for one train to hit another even if both engineers were asleep, and do you think they would install it even if I gave it to them? No, life is cheap and it would cost them five hundred dollars to install this at each crossing and two hundred for the attachment on the engine. It is not a question of life with the roads; it is a question of money. The Almighty God of Gold. That is the reason why accidents can come and go, and no attention is paid to them unless they lose someone belonging to themselves.

P. R. George,
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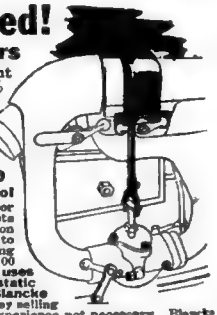

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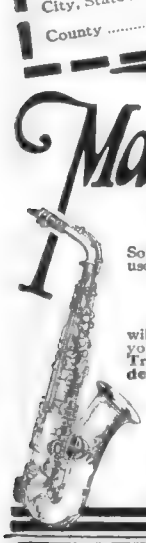

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(It is a known fact that the railroads in the United States spend a great deal of money for maintenance, repairs and improvements. The difficulty is that a great many inventors believe that their ideas are practical, when as a matter of fact the systems are entirely unsuited and could never be applied. A device to be approved must work in all kinds of weather, under all conditions, and on all types of track. This includes the sharp curves, the steep grades, long tunnels, narrow bridges, etc. We are quite sure that if you had built a working model of your system, and had demonstrated it to the proper railway concerns and showed them where the system meant a saving in life, as well as in actual money, the officials of the concern would have listened to your plea. —Editor.)

ELECTRICITY FROM THE SUN

Editor, *Science and Invention:*

On page 846 of the January, 1922, issue of SCIENCE AND INVENTION, in question No. 1172, you mention having knowledge of five inventors, who claim to derive electricity from the air or by the action of the sun upon certain chemicals. I wish you to give me the names of the inventors and what data you can on the subject, for I am very much interested in locating a certain man, engaged in this work. They say truth is stranger than fiction; and it is, in this case—but the following are absolute facts, that can be vouched for by myself, my father, the superintendent of our lumber camp, and some of the resident mountaineers.

On the morning of July 16th, 1918, three of us left Blairs Mills, Huntingdon County, Penna., to cross the Kineamajig Mt. to New Germantown, Perry County, Penna. We saw a fine tract of timber in the Dead Horse Valley, between the Tuscarora and Kineamajig, and left the car along a back road and tramped up through the valley a mile or more and then started for the summit of the Kineamajig. It was a broiling hot day, and about noon we entered a little clearing, where was built a substantial log cabin with a flat top. Interested in finding such a well-kept place in this section, and wishing to learn all possible about the timber, we struck up a conversation with the elderly man—by his conversation one could tell he was not a native of the mountains. But he proved a veritable encyclopedia for information relative to the surrounding country. We never question mountaineers about their business, so went on in search of various timbers. Driven by an approaching thunderstorm, we hurried back to the shack for shelter—the old man was busy on the roof of the cottage covering something, but gestured for us to enter inside—which we did, and were amazed to find ourselves in a perfectly appointed, ELECTRICALY LIGHTED library. As we knew there were no large streams near, and we had noticed no wires outside, we were surprised, and naturally asked the man the circumstances, when he finally came down from the roof. Then he explained that for years he had been working on the problem of making the sun produce electricity, and had almost solved the problem to make it commercially possible. After the storm had passed over he took us to the roof of the cabin, and showed us "the production cells," as he called the large number of glass jars. He claimed that by exposure of these cells to the sun for two days he could generate and store up sufficient electricity to light his cabin for one week, continuous lighting. Of course, this all seemed like a fake idea, but there was the proof. We had to hurry along back to our car in order to get back to our camp by night, so we asked the man for his name and address in case we could ever use his idea or aid him. He gave his name, but no address, and said we could always find him at the cabin. He did ask us not to mention this to anyone and we, the three of us, never have, until now, I am writing to you. We did go back there again in the spring of 1919, but all we found was a tumb'ed-down log cabin, falling to pieces, and some mountaineers had told our superintendent of a big truck going up the valley early in the preceding Fall and returning the following day with a big load, all covered with tarpaulins.

I hope you can give me the names and addresses of the inventors who claim they can produce electricity by this means, and I shall try to find out if any of them are the one I am seeking.

Of course there is considerable I have not told; should I not find the name among the list you send me, I should be glad to write you an article and giving the data as I remember it. It would serve as feature material for your magazine.

As a clue to your search; several years ago, before a meeting of an Engineering Society in New York City, on the same program with Dr. Geo. Spratt, the man who is the possessor of all the papers of the late Octave Chanute, there was a lecturer who spoke on this subject—of making the sun produce electricity. This was about two years ago.

R. C. Templin,
Coatesville, Pa.

(Has any one of our readers heard of this particular method of obtaining electricity from the sun? We will appreciate hearing from you on this point. There are several experiments which have been made along this particular line in a smaller way, but none to the extent mentioned in the above letter.—Editor.)

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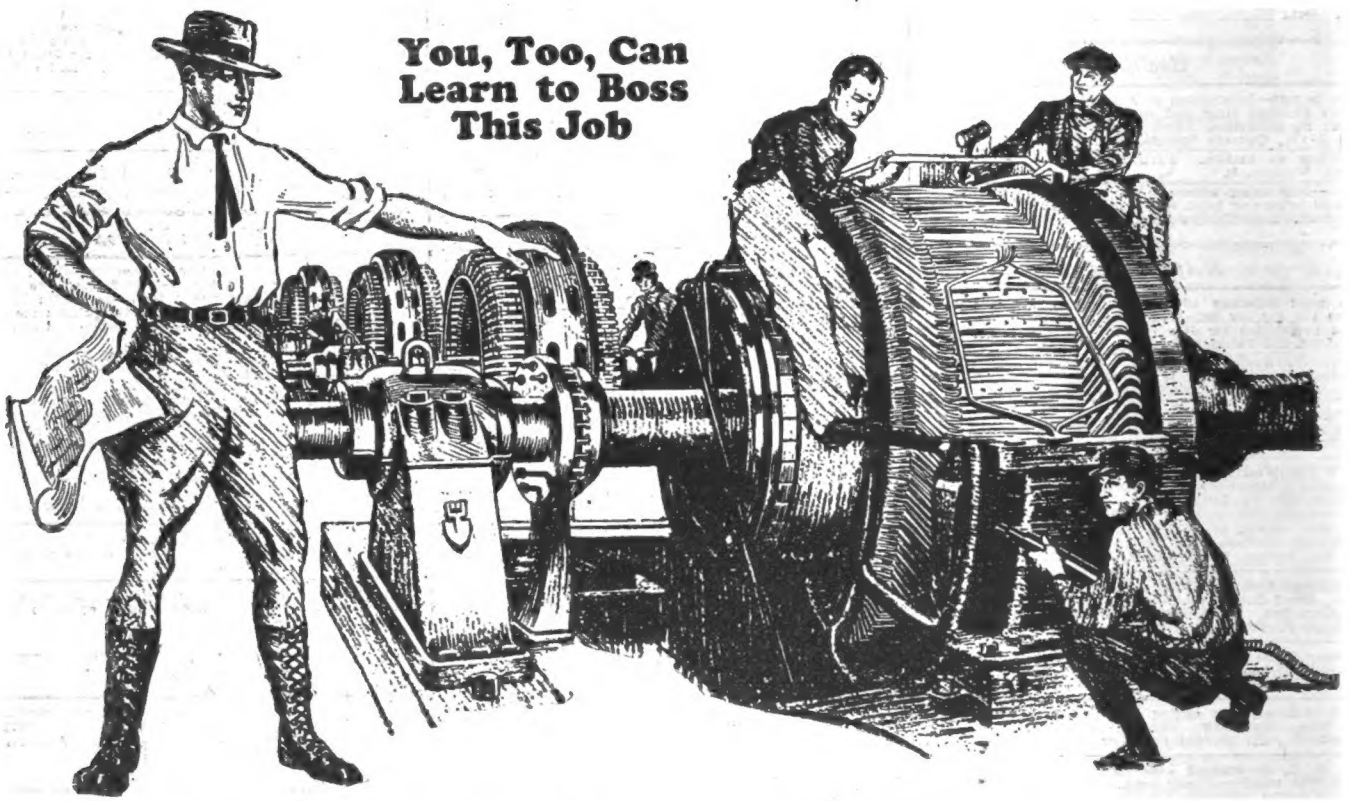

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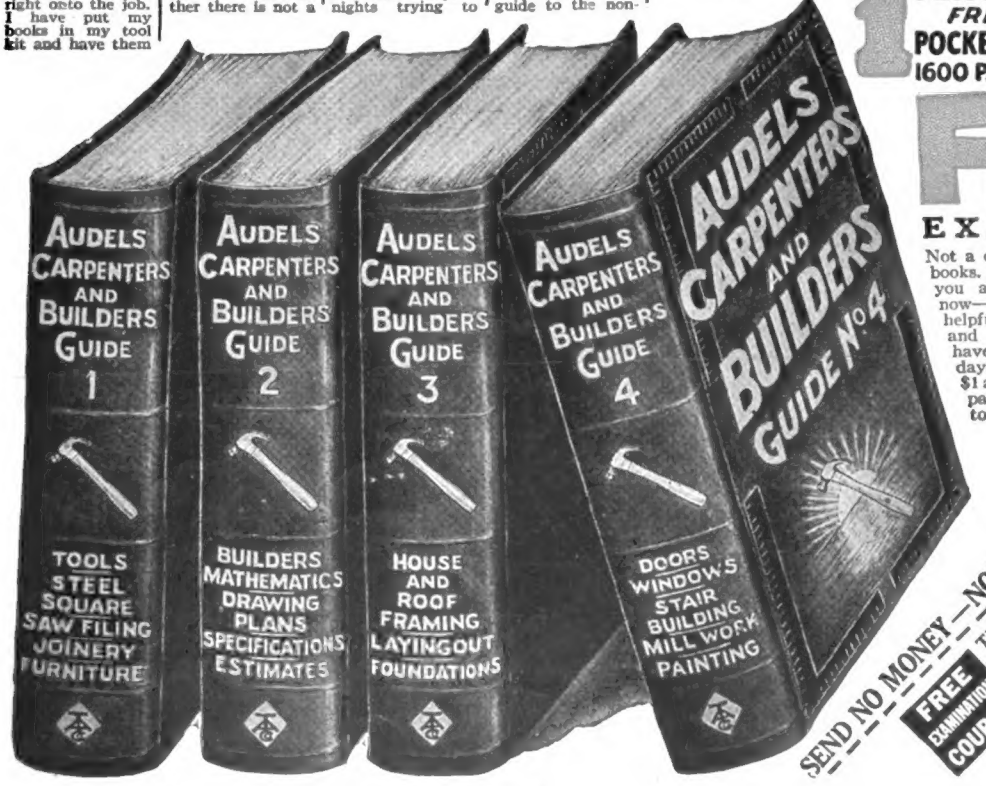
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